HERPETOLOGY OF JAPAN AND ADJACENT TERRITORY.

By Leonhard Stejneger,
Curator, Division of Reptiles and Batrachians, U. S. National Museum.

INTRODUCTION.

Until a comparatively recent date reptiles and amphibians were generally considered members of the same class, intermediate between the old class Pisces and the birds. True, the Amphibia were elevated to class rank early in the last century, but the proposition was not generally accepted until the subdivision of the vertebrates into Anamnia and Amniota had been gaining ground. It is now generally conceded that the Amphibia, or Batrachia, as they are often called, are more nearly allied to the fishes, and the reptiles more so to the birds than the two classes are among themselves, some authors even going so far, and not without good reasons, as to include the reptiles with the birds in the same class, Monocotylia. Yet, chiefly for the same reasons which cause the Lancelets and the Lampreys to be embraced with the true fishes in the term "ichthyology," the old name for the study of the compound class Amphibia or Reptilia, "herpetology," is still in common use, and in faunistic works, like the present, the two classes are usually treated of together.

Class AMPHIBIA.

1758. *Amphibia* Linnæus, Syst. Nat., 10 ed., I, p. 194.
1802. *Batrachia* Macartney, in Ross's Translat. Cuvier's Lect. Comp. Anat., I, tab. III.
1803. *Batrachii* Daudin, Hist. Nat. Rept., V, tab. p. 8.
1806. *Batracii* Duméril, Zool. Anal., p. 90.
1807. *Calamitæ* Link, Beschr. Nat. Samml. Rostock, II, p. 53.
1813. *Achelata* Fischer, Zoognosia, 3 ed., I, p. 57.
1814. *Ranaeea* Wilbrand, Classif. Thiere, p. 117.
1820. *Nuda* Hemprich, Grundr. Naturg., p. 111.
1821. *Dipnoa* Leuckart, Isis, 1821, Litt. Anz., p. 259.
1847. *Malacopoda* Mayer, Rheinl. und Westphal. Verhandl., VI (p. 177).
1855. *Psiloderma* van der Hoeven, Handb. Dierk., 2 ed., II, p.—; Handb. Zool., II, p. 251.

The amphibians, or batrachians, as they are also called, are anamniote, archæcraniate, and stomatophysous vertebrates possessing a well-developed skull provided with a lower jaw and articulating with the vertebral column by means of two occipital condyles; limbs, when not atrophied, consisting of humerus or femur followed by two propodials (radius and ulna, tibia and fibula), metapodials (carpals and metacarpals, tarsals and metatarsals), and digits (phalanges); heart with three chambers; internal nares; respiration, at least during part of life, by means of gills; skin naked. Young, usually after leaving egg, undergoes a metamorphosis.

The term "Batrachia," usually applied to this class, has to be rejected and "Amphibia" accepted, since it has been shown that the former name originally applied only to the order of tailless frogs, and that consequently it is a synonym pure and simple of the much older term Salientia.[a]

The class includes three recent orders, namely, the Cæcilians (Apoda), the Salamanders (Caudata), and the Frogs (Salienta). Of these only the two latter orders are represented within our present limits.

Order CAUDATA.

1806. *Caudati* Duméril, Zool. Anal., p. 94.
1811. *Caudata* Oppel, Ordn. Rept., p. 72.
1813. *Urodeli* Fischer, Zoognosia, 3 ed., I, p. 58.
1820. *Gradientia* Merrem, Syst. Amph., p. 166.
1825. *Urodela* Latreille, Fam. Nat. Règne Anim., p. 105.
1828. *Cercopi* Wagler, Isis, 1828, p. 859.
1833. *Sozura* van der Hoeven, Handb. Dierk., II, Pt. 2, p. 304.
1835. *Homomorpha* Fitzinger, Ann. Wien. Mus., I, p. 107.
1838. *Urophora* Hogg, Mag. Nat. Hist. (n. s.), III, p. 270.
1855. *Saurobatrachi* van der Hoeven, Handb. Dierk., 2 ed., II, p. 461.
1857. *Delesura* Jan, Cenni Mus. Milan., p. 54.

This order is often called Urodeles or Urodela, and Duméril (Zoologie Analytique, 1806) is quoted as authority. This is a mistake, however, for Duméril only uses the French term "Urodèles," adding in parentheses the Latin word by which he designates the group, namely, Caudati. From an inspection of page 94 this is plain enough, but to clinch the matter one needs only examine the two indexes at the end of the book, the "Table Française" containing the word "Urodèles" (p. 330), and the "Table Latine" the *Caudati* (p. 333). The Latin forms "Urodela" and "Urodeles" have been introduced much later by other authors.

This order may be divided into three suborders, viz, the Mudpuppies (Proteida), the Sirens (Meantes), and the true Salamanders (Mutabilia), only the latter being found in the territory here included.

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[a] See Stejneger, Science (n. s.), XX, Dec. 30, 1904, pp. 924–925.

Suborder MUTABILIA.

1820. *Mutabilia* Merrem, Syst. Amph., p. 166.
1820. *Salamandræ* Goldfusz, Handb. Zool., II, p. 129.
1828. *Morphuromolgæ* Ritgen, Nova Acta Acad. Leop. Carol., XIV, p. 277.
1828. *Molgæ* Ritgen, Nova Acta Acad. Leop. Carol., XIV, p. 277.
1832. *Derotremata*+*Salamandrina* Mueller, Isis, 1832 (p. 504).
1831. *Urodela* Bonaparte, Saggio Distrib. Met., p. 77.
1840. *Deirotremata*+*Aphanobranchiata* Leuckart, Froriep's Neue Notizen, XIII, p. 20.
1866. *Sozura* Haeckel, Gen. Morphol., II, p. cxxxi.
1866. *Caducibranchiata* Cope, Journ. Phila. Acad. Sci., VI, Pt. 1, p. 102.
1889. *Pseudosauria* Cope, Amer. Natural., XXIII, 1889, p. 861.

In the true salamanders we recognize two superfamilies, viz, the Amphiumoideæ and the Salamandroideæ. For our present purpose it is enough to separate them by the presence of well-developed eyelids in the latter and the absence of eyelids in the former. It is stated that the absence of eyelids is concurrent with the absence of a first epibranchial and with the connection of stapes with the quadrate arch in the Amphiumoideæ, while in the Salamandroideæ a first epibranchial is present and stapes not connected with the quadrate arch in the adult. The Amphiumoideæ correspond to Cope's Trematodera and Amphiumoidea, and to Boulenger's Amphiumidæ, while the Salamandroideæ are the latter's Salamandridæ and Cope's Pseudosauria (1889, N. Am. Batr., p. 33; not of 1898, Syllabus, p. 48, where the term corresponds strictly to our Mutabilia).

Both superfamilies occur within our limits. The genera which belong to them may be referred to their respective groups as follows:

ANALYTICAL KEY TO FAMILIES.

a^1 (Amphiumoideæ.) No eyelids........................Cryptobranchidæ, p. 3.
a^2 (Salamandroideæ.) Eyelids developed.
  b^1 Vomero-palatine teeth in two longitudinal series diverging backward; vertebræ opisthocœlous..............................Salamandridæ, p. 11.
  b^2 Vomero-palatine teeth in transverse series, or converging backward; vertebræ amphicœlous.......................................Ambystomidæ, p. 24.

Superfamily AMPHIUMOIDEÆ.

Two families compose the superfamily Amphiumoideæ, the Amphiumidæ and the Cryptobranchidæ, differing in many anatomical characters, the former represented by the eel-like *Amphiuma* with at most three digits on the rudimentary legs, the latter by the hellbender, with its more salamander-like body, 4–5 digits and well-developed limbs. The former occurs only in North America.

Family CRYPTOBRANCHIDÆ.

This family embraces three genera, *Proteocordylus* (*Andrias*), known only from the miocene of western Europe, *Cryptobranchus*, which only occurs in eastern North America, and *Megalobatrachus,* known from Japan and China. They are so closely allied that osteologists and paleontologists prefer to regard the two latter at least as congeneric, but the closing of the branchial fissure in the adult *Megalobatrachus* seems to be sufficient reason for adopting the latter genus. In the American genus the fissure remains open throughout life.

Genus MEGALOBATRACHUS[a] Tschudi.

1837. *Megalobatrachus* TSCHUDI, Neues Jahrb. Mineral. Geol. Palæont., (Stuttgart) 1837, Pt. 5, September, p. 547 (type, *M. sieboldi*).
1838. *Sieboldia* BONAPARTE in Gray, Ann. Mag. Nat. Hist., May, 1838, p. 413 (same type).
1838. *Sieboldtia* AGASSIZ, in Anhang to Tschudi's Classif. Batr. (err. typogr.).
1840. *Hydrosalamandra* LEUCKART Froriep's Neue Notizen, XIII, No. 2, Jan. 1840, p. 20 (same type).
1854. *Tritomegas* DUMÉRIL and BIBRON, Erpét. Gén., IX, p. 163 (same type).
1904. *Sieboldiana* ISHIKAWA, Proc. Nat. Hist. Tokyo Imp. Mus., I, No. 2, p. 21 (emendation).

Unless it can be shown that Bonaparte published his *Sieboldia* before September, 1837, it will have to give way to Tschudi's *Megalobatrachus.* Agassiz (l. c.), on September 29, 1838, speaks of "the established priority" of the former,[b] but, like many later authors, he evidently regarded *Megalobatrachus* as first proposed by Tschudi in his "Classification der Batrachier," which Agassiz himself published in October, 1838. As will be seen from the above synonymy Tschudi had already published it in September, 1837, a fact of which Agassiz was apparently unaware.

Few animals can boast such an extensive literature as the Japanese giant salamander. The bibliography attached to this work and the synonymic list of quotations under the head of the species, greatly defective as they are, give a fair indication of the interest this animal and especially its anatomy has aroused among naturalists. It is only recently, however, that accurate and detailed observations on its habits and propagation have been made. A good account based upon ample experience in the field has been published by Prof. C. Sasaki,[c] and recently Prof. C. Ishikawa has supplemented his notes by very important observations on the eggs and newly hatched young.[d] Finally, Dr. C. Kerbert, in Amsterdam, has succeeded in making the giant salamander breed in captivity, thus being able to follow the process from the laying of the eggs to the hatching of the larvæ and their subsequent growth and change. A brief summary of their observations may be included here. According to them the giant salamander inhabits high mountain valleys, where it frequents the swift-running brooks of clear cold water from the mountain springs. These streams are quite shallow, have stony beds, seldom attain a width of more than a few meters and are for the most part shaded with shrubs and trees. The temperature of the water in the middle of August was found to be between 17° and 23° C. Here they keep themselves habitually in dark holes under rocks, along the banks or the middle of the stream, and cavities inhabited by one of these animals may be recognized by the bottom at the entrance being kept clean. They feed on fishes, frogs, crustaceans, earthworms, etc, and are easily captured by a baited fishhook thrust into the retreat of the sluggish animal. The flesh, which is eaten by the Japanese, is said to be delicious, and is also used for medicinal purposes. Another mode of capturing the salamander during the breeding season is to throw into the stream a strong-smelling mixture of various animal ingredients made into small balls, thereby enticing the animals out of their holes. As a result, the "hanzaki" is constantly becoming scarcer. Only the smaller and medium-sized individuals stay in the small, shallow streams, the big old monsters of 3 feet and more seek deeper water lower down. The eggs are deposited in August and September in the deep holes. They vary as to size and number according to the size of the female, and consist of an outer gelatinous envelope or capsule 16 to 20 mm. long, in which the spheroid egg floats in a clear fluid. Each capsule is connected with the next by means of a comparatively short string about equaling the length of the larger axis of the embryo, the whole deposit resembling a rosary in form. Kerbert estimates the number of eggs deposited by the female in the Amsterdam Aquarium at about 500. Ishikawa found 60 to 80 in the various holes examined by him. The entire development from the deposition of the eggs to the escape of the larva from the capsule lasted in captivity from fifty-two to sixty-eight days, the escaping larvæ measuring about 30 mm. in length. At this time they have external gills; the anterior extremities show indications of two fingers and the posterior limbs are indicated; the mouth which is still plainly ventral becomes gradually terminal. The gills seem to disappear when the young are between 200 and 250 mm. in length. Both Ishikawa and Kerbert maintain that the adult animal takes care of the eggs, wrapping the egg string around itself and by its movements keeping the mass in motion so as to facilitate the respiration process of the eggs and embryos; but they differ in opinion as to whether it is the male or the female who thus undertakes the care of the offspring, Ishikawa from observations in nature maintaining the latter, Kerbert from the behavior of the animals in the aquarium the former.

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[a] From *μεγάλος = μέγᾰς,* great; *βᾰ́τρᾰχος*, frog, or, in this case, batrachian.

[b] "Die constatirte Priorität seines Namens Sieboldtia."

[c] Journ. Coll. Sci. Tokyo, I. Pt. 3. 1887, pp. 269–274.

[d] Proc. Nat. Hist. Tokyo Imp. Mus., I, No. 2, 1904, pp. 19–37.

MEGALOBATRACHUS JAPONICUS[a] (Temminck).

HANZAKI (Ishikawa).

1837. *Triton japonicus* Temminck, Fauna Japon., Pt. 3, Coup d'œil, p. xxvi (Japan).—Wagner, Muenchen Gelehrte Anzeiger, V, July 8, 1837, p. 55.—van der Hoeven, Tijdschr. Natuurl. Geschied., IV, Feb. 1838, p. 375.—*Cryptobranchus japonicus* van der Hoeven, Tijdschr. Natuurl. Geschied., IV, Feb. 1838, p. 384, pl. v*a*, figs. 5–6 (Japan); Bull. Sci. Phys. Natur. Néerlande (Leiden), 1838, p. 91; Proc. Zool. Soc. London, 1838, p. 25; Ann. Mag. Nat. Hist., II, Nov. 1838, p. 230; Ann. Sci. Nat., (2) Zool., XI, 1839 (p. 63); Mém. Soc. Hist. Nat. Strasbourg, III, 1840, author's separate, p. 11, pls. — ; Ann. Sci. Nat., (2) Zool., XV, 1841, p. 251 (151 by typogr. err.); Tijdschr. Natuurl. Geschied., VIII, 1841, p. 270 (blood corpuscles).—Schmidt, Goddard, and van der Hoeven, Nat. Verh. Maatsch. Wet. Haarlem, XIX, 1862, p. 3 (anatomy).—Hyrtl, De Cryptobr. Jap., 1865, p. 9 (descr.; anat.).—Rein and von Roretz, Zool. Garten, XVII, 1876, p. 33, pl. — (distrib.; habits, etc.).—Boettger, Zool. Garten, XVII, 1876, p. 432 (young).—Dambeck, Natur (Halle) (n. s.), III, 1877, (p. 685).—Wiedersheim, Kopfskel. Urodel., 1877, p. 56, pl. ii, figs. 21–22 (skull).—Cornalia, Atti. Soc. Ital. Sci., XXI, 1878, p. 207 (dimensions).—Hilgendorf, Sitz. Ber. Naturf. Freunde, Berlin, 1880, p. 121.—Bieletski, [Rem. Physiol. Sal. Gig., 1882] p. — pl.—.—Geerts, Nouv. Arch. Mus. Paris, (2) V, 1883, p. 274, pl. xvii.—Rein, Japan, Engl. ed., 1884, p. 188 (Hida to Iwami).—Sasaki, Journ. Coll. Sci. Tokyo, I, Pt. 3, 1887, p. 269 (Iga; Ise; Yamato; habits, eggs, etc.).—Moesch, Neujahrsblatt Naturf. Ges. Zuerich, 1887, p. 1, figs. 1–4 (full fig. and skel.).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, 1891, p. 239 (absent in Yezo).—Meuron, Bull. Soc. Sci. Nat. Neuchâtel, XXI, 1893, p. 186.—Gadow, Cambr. Nat. Hist., VIII, 1901, p. 98 (fig.).—Osawa, Mitth. Med. Fac. Univers. Tokio, V, no. 4, 1902 (pp. 221–427 + 44 pls.) (anatomy).—*Andrias japonicus* Lapparent, Traité Geol., 4 ed., 1900, p. 1532.—*Megalobatrachus japonicus* Beddard, Proc. Zool. Soc. London, 1903, II, Pt. 2 (publ. Apr. 1904) p. 298 (anatomy).

1837. *Megalobatrachus sieboldi* Tschudi, Neues Jahrb. Mineral. Geol. Palæont., 1837, Pt. 5, Sept., p. 547 (type-locality, Japan; type in Leiden Mus.; Siebold collector); Classif. Batr., Oct. 1838, p. 96, pl. vi (Japan).—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1876, p. 384 (southern Japan).—*Tritomegas sieboldii* Duméril and Bibron, Erpét. Gén., IX, 1854, p. 164.—Bleeker, Natuurl. Tijdschr. Nederland. Indië, XVI, 1858, p. 205.

1837. *Salamandra maxima* Schlegel in Tschudi, Neues Jahrb. Mineral. Geol. Palæont., 1837, Pt. 5, Sept., p. 546 (not of Barton, 1808); Fauna Japon. Rept., pp. 127, 139, Saur. et Batr., pls. vi, vii, viii (type-locality, "Suzuga yama near Sakanosta",[b] Okude mountains).—Siebold, Fauna Japon., Rept., 1838, p. xv.—Pompe van Meerdervoort, Natuurk. Tijdschr. Nederland. Indië, XX, Pts. 4–6, 1860, p. 386.—*Sieboldia maxima* Gray, Cat. Batr. Grad. Brit. Mus., 1850, p. 52 (Japan).—Phisalix, Compt. Rend. Acad. Sci. Paris, CXXV, 1897 (p. 121) (poisonous secretions); Bull. Mus. Hist. Nat. Paris, 1897 (p. 242).—*Megalobatrachus maximus* Boulenger, Cat. Batr. Grad. Brit. Mus., 1882, p. 80 (Japan).—Okada, Cat.

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[a] Signifying Japanese.

[b] Evidently Sudsaka Yama near Sakanoshita, of Hassenstein's Atlas of Japan, the mountain where the boundaries between the provinces of Iga, Ise, and Omi meet.

Vert. Japan, 1891, p. 65 (Mimasaku; Ise; Iga; Hida; Mino; Ivami; Tamba; Tajima).—BOETTGER, Kat. Batr. Mus. Senckenberg., 1892, p. 60 (Iga).—ANDRES, Atti Soc. Ital. Sci. Nat., XXXV, fasc. 3–4, 1896, p. 201, pl. I (descr.; general).—SCHNEE, Natur und Haus, VIII, 1900 (p. 246) (notes on living spec.).—ISHIKAWA, Mitth. Deutsch. Ges. Ost-Asiens, IX, Pt. 1, 1902, p. 81 (Hondo from Mino to Suwo and Nagato; habits, propagation, etc.); Proc. Nat. Hist. Tokyo Imp. Mus., 1, No. 2, 1904, p. 19, pls, VIII–XI (general; distrib.; propag.; develop.).—KERBERT, Tijdschr. Nederland. Dierk.Vereen. (2), VIII, 1903 (pp. XXVIII–XXIX) (eggs); Zool. Anz., XXVII, 1904, Feb. 23, p. 305 (propagation, etc.); Compt. Rend. Sixth Int. Zool. Congr. Berne, 1904, (1905) p. 463 (propagation).—*Cryptobranchus maximus* CHAPMAN, Proc. Phila. Acad., 1893, p. 227 (anat.).

1840. *Hydrosalamandra siboldi* LEUCKART, Froriep's Neue Notizen, XIII, p. 20 (err. typ.).

1854. *Salamandra gigas* "Schlegel" DUMÉRIL and BIBRON, Erpét. Gén., IX, p. 164 (*lapsus.*).

1854. *Tritomegas sieboldtii* DUMÉRIL and BIBRON, Erpét. Gén., IX, p. 426 (err. typ.).

1907. *Cryptobranchus sieboldia* CALMETTE, Les Venins, p. 330, fig. 123.

The above quotations refer to Japanese specimens. A *Sieboldia davidiana* has been described by Blanchard[a] from China, which Boulenger, however, regards as identical with the Japanese species. I have no means of verifying this identification. P. Krefft (in Verh. Ges. Deutsch. Naturf. Aerzte, 69 Vers. Braunschw., 1897, II, Pt. 1, 1898, p. 187) treats of specimens believed to be from Amoy and Canton, and refers them "auf Grund allerdings oberflächlicher Untersuchung" to *Cryptobranchus japonicus*. Gray, in 1873 (Ann. Mag. Nat. Hist. (4), XII, 1873, p. 188) mentions a skin including the bones of head and feet sent by Swinhoe from Shanghai, which he could not distinguish from a Japanese specimen.

There has been almost as much confusion about the specific name of the giant salamander as there has been with the generic term.

The oldest name is Temminck's *Triton japonicus*, which was published in his "Coup d'oeil," the introductory chapter to the Fauna Japonica, probably as early as March or April, 1837, and certainly not later than June of that year (see Bibliography, p. 542). In that paper which was penned as early as November, 1835, Temminck described the giant salamander sufficiently to give the name *Triton japonicus* a status in zoological nomenclature.[b]

Description.—Half grown; U.S.N.M. No. 11349; Japan; Prof. E. S. Morse, collector. Vomerine teeth in an arched series between the choanæ, parallel with the maxillary and premaxillary series; whole body strongly depressed except terminal two-thirds of tail which is strongly compressed; head broad, flat; nostrils anterior, near the tip of the snout and the lips, their distance from each other less than one-half the distance between the eyes, which are without eyelids and very small, their diameter being less than one-tenth of the distance between them; legs short, depressed; fore legs with four fingers slightly webbed at base, the outer one with an outer dermal fold which continues along the entire length of the arm; hind feet with five toes webbed at base, the two outer ones with a distinct dermal flap on the outer side; a broad cutaneous expansion on the posterior aspect of the leg; tail short, slightly more than one-third the length of head and body, compressed, with a high dorsal fin beginning at the insertion of the hind legs, and a much lower ventral fin; a strong lateral fold on the neck from behind the angle of mouth to above the shoulder; another prominent undulating lateral dermal fold from the axilla to above the hind legs; skin rough, with numerous grooves, transverse on underside of body and on the sides, longitudinal on the throat; head above covered with closely set round tubercles which are somewhat smaller than the eyes, but not arranged with any degree of regularity or symmetry; lips, tips of snout, and a limited area along the median line of the top of head comparatively smooth; similar tubercles, though more scattered on sides of throat and on upper side of neck, a few occurring irregularly along the entire side of the body above the lateral fold. Color (in alcohol) burnt umber in various shades, paler below, irregularly blotched and marbled with dusky spots, limbs similarly spotted, tips of digits light orange brown.

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[a] Compt. Rend. Acad. Paris, LXXIII, 1871, p. 79.—GRAY, Ann. Mag. Nat. Hist. (4), XII, 1873, p. 188.—*Sieboldia davidi* DAVID, Journ. Trois. Voy. Emp. Chinois, II, 1875, p. 20 (emendation) (S. W. Shensi).

[b] La *Salamandre* gigantesque, *Triton japonicus* porte des formes bizarres: une tête extremement large et deprimée, un corps applati muni d'une queue en forme de large aviron, le tout porté par des pieds très-courts; elle vit dans les eaux limpides des torrens. Coup d'oeil, p. XXVI.

Dimensions.

	mm.
Total length	490
Tip of snout to vent	322
Anterior border of vent to tip of tail	168
Width of head	69
Distance between eyes	40
Fore legs	52
Hind legs	59
Greatest height of tail	48

Few salamanders have been oftener described in detail, or oftener figured than the present species as will be seen from the synonymy given above, where ample references are cited. A more detailed description therefore seems superfluous. It may be added, however, that there is no apparent external difference between the sexes, except that during the breeding season the borders of the vent are swollen in the male, but flat in the female. The young ones differ chiefly in being less rough and lighter in color.

Habitat.—The giant salamander of Japan seems to be restricted to the higher altitudes of the island of Hondo west of longitude 137° 30′ east of Greenwich. Rein states that it lives in clear running mountain streams in the granite and schist ranges, at a height of from 400 to 1,000 meters above the sea, while Geerts mentions 200 to 800 meters as its true habitat. According to these two authorities the principal localities where it is found are as follows:

1. The mountain streams and sources of the Yodogawa and Lake Biwa drainage, especially the tributaries of the Kidzugawa in the provinces of Iga, Yamato, and western Ise. The type-specimen—which von Siebold brought home alive to the Leiden Museum—was taken in this district, namely, in one of the streams of Sudzaka Yama, the mountain where the boundaries of the three provinces of Ise, Iga, and Omi meet, and Mr. Sasaki, who, in 1880 and 1881, visited this part of Japan in search of this species, obtained all his specimens (71) in Iga, Ise, and Yamato.

2. The streams of the border mountains between Hida and Mino provinces, especially the sources and tributaries of Rokagawa. Mr. Geerts quotes Keisuke Ito (Nihon Sanbutu Si, II, p. 39) as authority for the statement that it occurs in the province of Owari, though judging from the maps accessible to me it seems doubtful whether there are any localities high enough in that province.

3. The streams on the watershed between the districts of Sanindo and Sanyodo. Geerts mentions several streams by name, such as Miyadugawa and Itigawa, in the province of Tamba, Toyokagawa, in Tazima, and Osakigawa in Mimasaku and Harima, while Rein also mentions the province of Iwami. Okada likewise names the province of Iwami, in addition to those of Mimasaku, Tamba, Tajima, Ise, Iga, Mino, and Hida, but upon what authority I do not know.

Professor Ishikawa, in a lecture given before the German East Asiatic Society in Tokyo, 1900,[a] gives the distribution of the giant salamander as follows: Mountain streams in the lower half of Hondo, i. e., from Mino to Iwami, Nagato, and Suwo. The species is consequently to be found in the mountain chain southwest from Mino to Suwo and Nagato, and also in the mountains of Iga and Ise, a branch of the main mountain chain. With regard to the provinces in which it occurs, the following are to be mentioned: Mino, Omi, Iga, Ise, Tamba, Tango, Tajima, Inaba, Mimasaku, Harima, Hoki, Bizen, Bitchu, Bingo, Idzumo, Iwami, Aki, Suwo, and Nagato. It has not been found as yet in Kii nor in Shikoku or Kiusiu. It occurs most frequently, so far as now known, in the mountain streams which come from the famous volcano Daisen, and in the streams on the south side of the Hiruzen Mountains and their neighborhood, especially in the sources of the rapid Asahigawa or river of the rising sun. For many years he collected the "hanzaki" in this part of the island, and he mentions the localities of Tsuyama, Onaru Valley, Kuginuki Valley, Mikamo, Maniwagori, all apparently in western Mimasaku. To his very interesting article, Contributions to the Knowledge of the Giant Salamander, in the Proceedings of the Department of Natural History, Tokyo Imperial Museum, I, 1904, he has added a colored map (Plate VIII) showing the distribution of the species. In this map the extension westward to the provinces of Nagato and Suwo is shown, and it also includes a large portion of the province of Idzumo. The text affords, however, no opportunity of judging upon what material this is based. This is particularly unfortunate as the testimony as to the occurrence of this species so far west is quite conflicting. According to a memorandum kindly furnished me by Dr. Hugh M. Smith, he was informed by Dr. T. Kitahara, zoologist of the Imperial Japanese Fisheries Bureau in Tokyo, that the western limit is the province of Bingo. The main drainage of the provinces of Tamba, Tazima, and Iwami is toward the Sea of Japan, the others drain to the inland sea, or to the Pacific, but the maps accessible to me are not accurate and detailed enough to decide whether some of the upper valleys of Iwami and Tazima do not in reality drain southward to the Inland Sea. At any rate it can not be taken for granted that the giant salamander occurs north of the watershed until its occurrence in streams of the Sea of Japan drainage is proven beyond a shadow of a doubt by actual specimens.

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[a] Mitth. Deutsch. Ges. Ost-Asiens, IX, p. 79.

In this connection it may be added that, according to Doctor Smith's memorandum alluded to above, "Mr. I. Shishido, teacher of zoology in the Third High School, Kyoto, states that the species is reported from near Funatsa, province of Hida, in a river flowing into the Japan Sea (Toyama Bay), but no specimens from that locality are known to be in collections. The people in the vicinity of Funatsu, especially thewomen, eat this animal as a medicine." It is of the greatest importance that this question, whether the giant salamander occurs originally (not introduced) and regularly in the Japan Sea drainage, should be definitely solved. The qualification "regularly" is added because an isolated occurrence would not be convincing, since it might be explained either as an accidental introduction, or as the result of a Japan Sea stream having captured the sources of a Pacific Coast stream.

The capture of specimens in the Takadagawa, province of Musashi, and at Kyoto, in 1832, in the canal of the castle Nizyono siro, as related by Handangensei (Keisuke Ito.[a]) probably refers to animals escaped from captivity or deliberately transplanted.

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[a] Nihon Sanbutu, Sci. II, p. 39.

List of specimens of Megalobatrachus japonicus.

U. S. N. M. No.	Age.	Locality.	When collected.	By whom collected or from whom received.
6163	Young	Japan		Colonel Taylor.
6543	do	do		C. E. Smidt.
11349	Half grown [a]	do		E. S. Morse.
34214	Adult [b]	Province Mino		A. Owston.
34215	do	do		Do.
34216	do	do		Do.
34217	do	do		Do.

[a] Description, p. 7.

[b] 618 mm. long.

Superfamily SALAMANDROIDEÆ.

The Salamandroids fall into three families, namely, the Ambystomidæ, Plethodontidæ, and Salamandridæ. The Plethodontidæ are characterized by the presence of parasphenoid teeth. They do not occur within our area, being confined, with one exception, to the New World.

The two families found in Japanese territory may be distinguished as follows:

KEY TO FAMILIES.

a^1 Vomero-palatines prolonged posteriorly over the parasphenoid as two long processes, the teeth placed on the inner side of these forming two parallel or backward diverging series .... SALAMANDRIDÆ, p. 11.

a^2 Vomero-palatines not prolonged backward over the parasphenoid, the teeth placed on the posterior margin in transverse or posteriorly converging series.
AMBYSTOMIDÆ, p. 24.

Family SALAMANDRIDÆ.

The salamanders, with the vomero-palatine teeth extending far backward in two parallel or posteriorly diverging series, are characteristic of the palearctic region, especially the Mediterranean subdivision. Three genera only occur in eastern Asia, two of which have been found within our territory. Of these, one, *Diemictylus,* extends into North America.

The Japanese genera may be distinguished as follows:

KEY TO GENERA.

a^1 Vomero-palatine teeth commencing in front of the line of the choanæ; series of isolated, knob-like glands on sides of back, some of these warts pierced by the extremity of the rib; maxillary bone reaching the quadrate; tip of pterygoid in contact with maxillary .... *Tylototriton*, p. 12.

a^2 Vomero-palatine teeth commencing on a line with the choanæ; no series of isolated knob-like glands on the sides of the back; maxillary bone separated from quadrate and from pterygoid by large intervals .... *Diemictylus*, p. 15.

Genus TYLOTOTRITON[a] Anderson.

1871. *Tylototriton* Anderson, Proc. Zool. Soc. London, 1871, p. 423 (type, *T. verrucosus*).

1885. *Tylotriton* Boettger, Offenbach. Ver. Naturk. 24–25 Ber., p. 165 (emendation).

1889. *Glossolega* Cope, Bull. U. S. Nat. Mus., No. 34, p. 201 (in part).

Thus far only two species of this genus are known, namely, T. *verrucosus*, which is known from the eastern Himalayas to the mountains of Yunnan, and the present species, which has been found only in Okinawa Shima. Doctor Anderson has given a detailed description, with illustrations, of the anatomy[b] of the type species.

The nearest related genus appears to be *Pleurodeles*, the only species of which, *P. waltl*, is confined to the southwestern portion of the Pyrenean peninsula and the northern portion of Morocco. The two genera agree not only in the singularly pointed ribs protruding through the sides of the body, sometimes even perforating the skin, but also in the forward extension of the vomero-palatine teeth.

The present distribution of these forms—one in Spain, one in the Himalayan region, and one in the Riu Kiu Archipelago—is suggestive of the antiquity of this type of urodeles.

TYLOTOTRITON ANDERSONI[c] Boulenger.

1892. *Tylototriton andersoni* Boulenger, Ann. Mag. Nat. Hist. (6), X, Oct. 1892, p. 304 (type-locality, Okinawa, Riu Kiu; type, Brit. Mus. No. 92. 9. 3. 30; Holst, collector).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 865; author's separate p. 16.—Boettger, Offenbach. Ver. Naturk., 33–36 Ber., 1895, p. 107 (Okinawa).

Description.—Adult; Sci. Coll. Tokyo, No. 67; Okinawa (figs. 1–6). Vomero-palatine teeth in two longitudinal series, meeting in front and commencing some distance anterior to a line through the anterior border of the choanæ, then proceeding backward nearly parallel, but considerable distance apart, then at the beginning of the posterior third sharply diverging; tongue nearly circular, its diameter more than half the width of the mouth, extensively free on the sides, less behind and least in front; nostrils near the tip of the snout, and halfway between the top and the edge of the lip, their distance from each other greater than their distance from the eye, but smaller than the interorbital space; upper eyelid small, its width less than one-third the interorbital space; top of head surrounded on the sides and anteriorly by a rather rough, bony crest which covers the tip of the snout, canthus rostrālis, supraorbital edge, and fronto-squamosal arch; parotoid gland scarcely as long as the width of the interorbital space, narrow, rather prominent; distance from tip of snout to gular fold contained less than three times in distance from gular fold to vent; fingers and toes interdigitating when legs are pressed against the sides of the body; a rough, bony ridge, similar to the one on the head, along the middle of the back, from occiput to the tail and continuous with the upper ridge of the latter; from the shoulder to the side of the tail a dorso-lateral series of knob-like glands on the body terminating the pointed end of the ribs, which protrude as hard spines, though not perforating the skin; this series continues some distance on the side of the tail, on which it gradually disappears; between this series and the median dorsal ridge another series of prominent, conical, bony knobs, about eight on each side, each one located over a rib and connected along the latter with the terminal rib knob by a series of smaller, less conspicuous, tubercles; fingers and toes rather short, depressed, with indication of a slight web at the base; fifth toe very short, rudimentary on the right foot, entirely missing on the left; no metacarpal or metatarsal tubercles; tail compressed, tapering from

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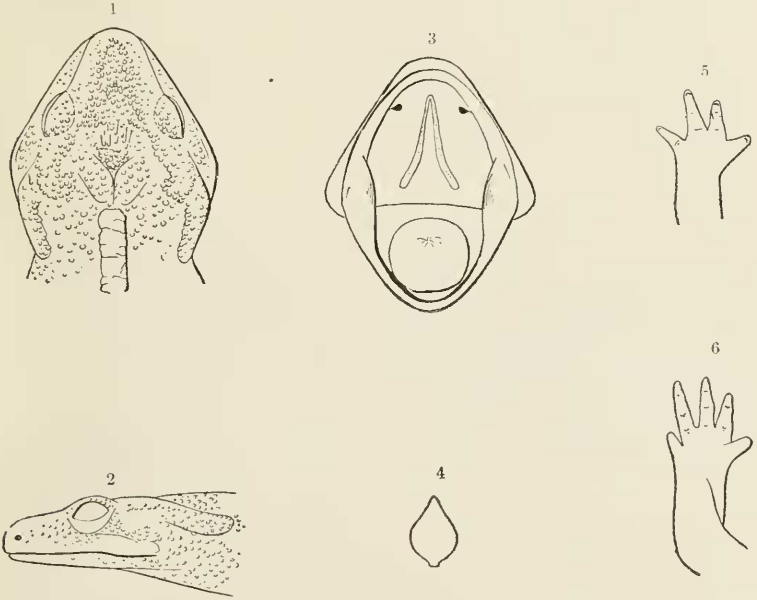
[a] From "τυλωτός, knobbed." "Along the body a lateral line of equidistant, large, rounded, knob-like, porous, glandular tubercles, terminating at the root of the tail. The second to fifth epipleural processes and the extremities of the remaining ribs terminate in the knob-like lateral glands." Anderson, Proc. Zool. Soc. London, 1871, p. 423.

[b] Zool. Res. Yunnan, p. 848, pl. lxxvii.

[c] "Named after Dr. J. Anderson, to whom science is indebted for the discovery of the remarkable newt on which he established the genus *Tylototriton* in 1871." John Anderson was born in Edinburgh, October 4, 1833; superintendent of Indian Museum, Calcutta, from 1865 to 1886; then occupied with the study of the fauna of Egypt till his death on August 15, 1900. He visited Japan in 1884.



FIGS. 1-6.—TYLOTOTRITON ANDERSONI. 1⅓ × NAT. SIZE. 1, TOP OF HEAD; 2, SIDE OF HEAD; 3, OPEN MOUTH; 4, SECTION OF TAIL AT END OF BASAL THIRD; 5, HAND; 6, FOOT. NO. 67, SCI. COLL., TOKYO.

the base, ending in a blunt point, upper and lower edge compressed, ridge-like; vent a short longitudinal slit with transverse folds or papillæ along the edges which are not raised or swollen; gular fold a slight depression; the whole body, including throat and legs above and below roughly granulated or tuberculated, the only smooth places being the lips, underside of hands and feet, and the lower edge of the tail. Color (in alcohol) above and below dark "mummy-brown," the bony ridges on head and back, as well as the two series of knobs on each side of the back, pale, like old ivory; underside of hands and feet, as well as lower edge of tail, yellowish.

Dimensions.

	mm.
Total length	159
Tip of snout to gular fold	21
Gular fold to anterior angle of vent	61
Anterior angle of vent to tip of tail	77
Width of head	21.5
Fore leg	25
Hind leg	27
Height of tail in the middle	6

Variation.—The specimen described above being only the second one known, it is obviously impossible to indicate the extent of individual variation in this species or even of sexual differences, as both specimens appear to be females. There are several points in which the two specimens differ, however. Thus, in the type the vomero-palatine series of teeth converge somewhat about the middle before the final flaring divergence. In the proportions there is, moreover, this difference, that in the type the tip of the toes reaches the elbow of the fore leg when the legs are pressed against the side; the length of the tail of the type is also proportionally greater. That the type is said to have an oval tongue and to be of a black color are differences of but slight consequence, but it is rather remarkable that the type does not appear to have the inner row of dorsal knobs differentiated to such a degree as to call for special mention in the original description.

Habitat.—The type of this species was discovered by Mr. Holst in Okinawa Shima, in 1892, and is in the British Museum. A second specimen, the one described above, belongs to the Science College Museum in Tokyo, the only ones thus far on record. This latter specimen is from the same locality as the type.

List of specimens of Tylototriton andersoni.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.
Sci. Coll. Tokyo......	67	Adult fem.[a]	Okinawa shima..........	....	....

[a] Description, p. 12: figs. 1-6.

Genus DIEMICTYLUS[a] Rafinesque.

1820. *Diemictylus* Rafinesque, Annals of Nature, 1820, No. 1, p. 5 (type, *T. viridescens*).
1820. *Notophthalmus* Rafinesque, Annals of Nature, 1820, No. 1, p. 5 (type, *T. miniatus*).
1838. *Cynops* Tschudi, Classif. Batr., p. 94 (type, *C. subcristatus*).
1850. *Taricha* Gray, Cat. Batr. Grad. Brit. Mus., p. 25 (type, *T. torosa*).
1858. *Diemyctylus* Hallowell, Journ. Phila. Acad. (2), III, p. 362 (emendation).
1878. *Triturus* Boulenger, Bull. Soc. Zool. France, III, p. 307 (type, *T. viridescens*) (not of Rafinesque, 1815).
1879. *Pelonectes* Lataste, Rev. Internat. Sci., III (p. 275), (type, *P. boscai*) (not of Fitzinger, 1843).

Professor Cope (Bull. U. S. Nat. Mus., No. 34, p. 203) has raised the question whether Rafinesque's *Diemictylus* has the priority over Merrem's *Molge* or not, both having been proposed in 1820. The question is immaterial, however, since *Molge* is a strict synonym of *Triturus*, Rafinesque (1815), both the latter names being assuredly only substitute names for *Triton*, preoccupied; hence they are in every respect identical and can not be used independently for different sections of the original genus *Triton*. *Molge* can never be used unless *Triturus* should become unavailable for some reason not now apparent. To the latter belong the species without a bony fronto-squamosal arch.

Two species of *Diemictylus* occur in Japan, one peculiar to Kiusiu, Hondo, and Shikoku, the other confined to the northern and central Riu Kius. The latter is a broader-headed form with shorter digits and longer tail, and Boulenger also indicates certain differences in the coloration of the live animals. The structural differences are very difficult to express in definite terms on account of the sexual and individual variability of these forms. It appears that the males have relatively longer digits than the females; consequently, in the female *D. pyrrhogaster* the digits are of about the same relative length as in the male *D. ensicauda*. On the other hand, the length of the tail—though undoubtedly averaging considerably longer in *D. ensicauda*—varies to such an extent individually as to baffle all my attempts at using it diagnostically. The head of the latter is also decidedly larger, but the variability of the other proportions renders the use of it illusory as a unit for comparative measurements. Nevertheless, the two forms are quite distinct, and it may be that a larger series of *D. ensicauda* in good condition (many of my specimens being rather hard and dry) will yield better results in the future.

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[a] Derivation and meaning obscure. Two derivations suggest themselves, namely, *διαμυκτος*, from *διαμιγνυμι*, or *δι-ἡμικοτυλος*, but the application of neither is obvious.

In the meantime the following key must suffice:

KEY TO JAPANESE SPECIES OF DIEMICTYLUS.

a^1 Head smaller; digits longer; tail shorter; color in life, underneath red, underside of digits blackish.. *D. pyrrhogaster*, p. 16.

a^2 Head larger; digits shorter; tail longer; color in life, underneath, including underside of digits, yellowish................................ *D. ensicauda*, p. 21.

DIEMICTYLUS PYRRHOGASTER[a] (Boie).

IMORI.

Plate II.

1826. *Molge pyrrhogaster* Boie, Isis, 1826, p. 215 (type-locality, Japan; Blomhoff, collector); Bijdr Natuurk. Wetensch., II, Pt. 1, 1827, p. 27.—*Molge pyrrhogastra* Boulenger, Cat. Batr. Grad. Brit. Mus., 1882, p.19 (Nagasaki; Kiukiang Mts. China).—Okada, Cat. Vert. Jap., 1891, p. 65 (Tokyo; Kyoto; Kaga; Suwo).—Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 101; Kat. Batr. Mus. Senckenberg., 1892, p. 56 (Yokohama; Nagasaki).—Sclater, List Batr. Indian Mus., 1892, p. 35 (Hakone; Lake Biwa).—*Cynops pyrrhogaster* Gray, Cat. Batr. Grad. Brit. Mus., 1850, p. 25 (Japan).—Boulenger, Bull. Soc. Zool. France, 1880, p.39.—Hilgendorf, Sitz. Ber. Naturf. Fr. Berlin, 1880, p. 120 (Tokyo; prov. Kazusa; Hakone Mts.).—*Triton pyrrhogaster* Strauch, Mém. Acad. Sci. St. Pétersb. (7), XVI, No. 4, 1870, p. 51 (Japan; China?).—Iwakawa, Quart. Journ. Microsc. Sci., XXX, 1882, p. —; Zool. Anz., V, 1882, p. 10.—*Salamandra pyrrhogastra* Geerts, Nouv. Arch. Mus. Paris, (2) V, 1881, p. 275 (Japan).—*Diemyctylus pyrrhogaster* Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 201.

1838. *Salamandra subcristata* Schlegel, Fauna Jap. Rept., pp. 125–139; Saur. et Batr. pl. IV, figs. 1–3;[b] pl. V, figs. 7–8 (type-locality, Japan; types in Leiden Mus.; Siebold and Buerger, collectors); Abbild. Amph., 1844, p. 122, pl. XL, figs. 1–3 (color from life).—*Cynops subcristatus* Tschudi, Classif. Batr., 1838, p. 94, pl. II, figs. *a–c.*—*Triton subcristatus* Duméril and Bibron, Erpét. Gén., IX, 1854, p. 140 (Japan).—Hallowell, Proc. Phila. Acad., 1860, p. 494 (in part: "Japan").—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, pp. 109, 116; 1876, p. 384 (Yokohama).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, 1891, p. 239 (Yezo?).

1898. *Triton subcristatus* var. *typica* Krefft, Verh. Ges. Deutsch. Naturf. Aerzte, 69 Vers. Braunschw., 1897, II, Pt. 1, p. 187 (Tokyo; Kyoto).

1898. *Triton subcristatus* var. *immaculiventris* Krefft, Verh. Ges. Deutsch. Naturf. Aerzte, 69 Vers. Braunschw., 1897, II, Pt. 1, p. 187 (Kiusiu).

1906. *Triton pyrrhogaster* subsp. *typica* Wolterstorff, Abh. Mus. Magdeburg, 1906, p. 162.

Description.—Adult male; U.S.N.M. No. 31796; Kyoto, Hondo, Japan; April 20, 1903; Dr. Hugh M. Smith, collector. Vomeropalatine teeth in two closely approximated longitudinal series beginning between the choanæ and continued posteriorly to beyond a line between the corners of the mouth, in the anterior half nearly parallel, then strongly diverging; tongue small, its width about one-half that of the mouth; nostrils anterior, barely visible from above, their distance from each other considerably less than their distance from the

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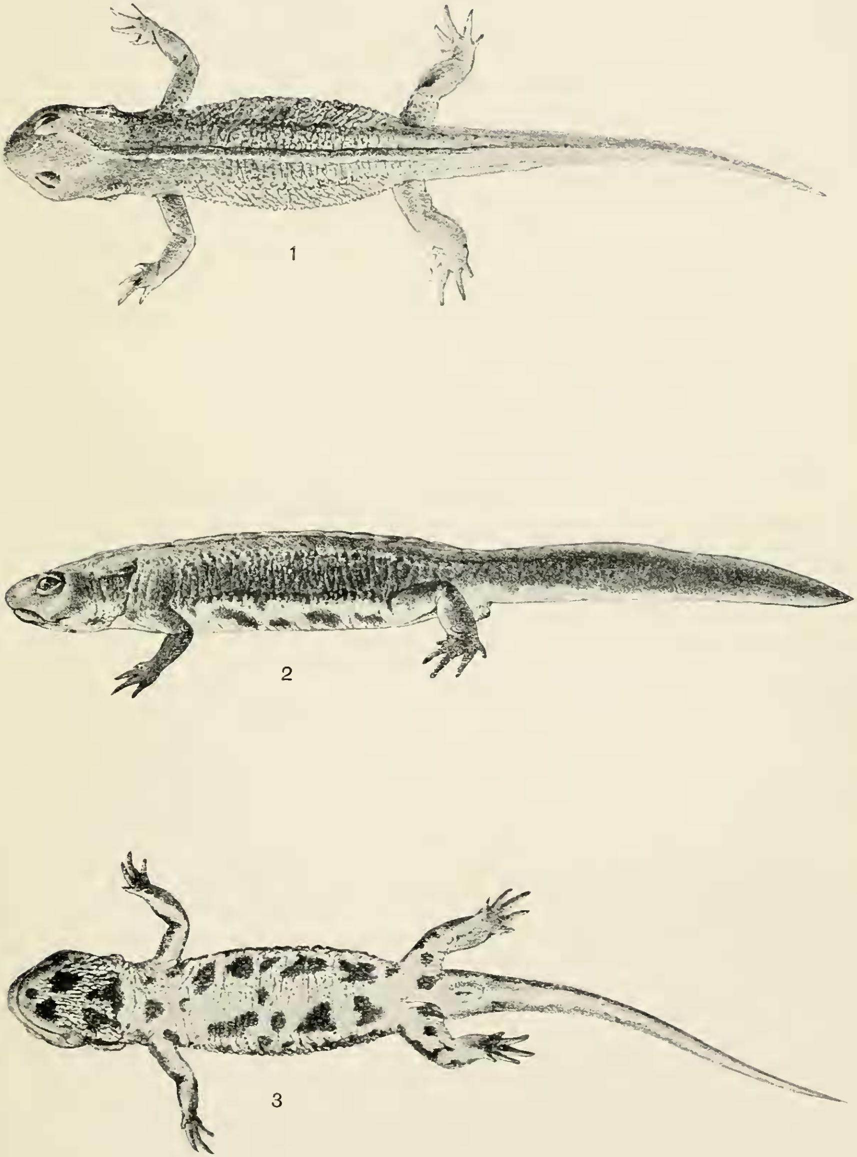
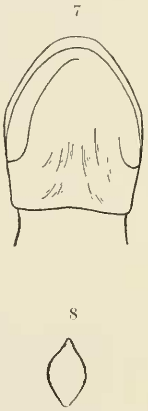
[a] From πυρρός, fiery red; γαστήρ, belly. [b] Reproduced in this work, Plate II.



DIEMICTYLUS PYRRHOGASTER. (FROM SCHLEGEL.)

FOR EXPLANATION OF PLATE SEE PAGE 553.

eyes and only about two-thirds the width of the interorbital space, which is nearly twice that of the upper eyelid; body moderate, the distance from tip of snout to gular fold (fig. 7) being contained three times in the distance from gular fold to anterior border of vent; legs rather long, tip of longest finger reaching knee and tip of longest toe reaching elbow when the limbs are adpressed to the sides of the body; digits long, depressed, without webs, third finger longest, third and fourth toes nearly equal and longest, first finger and first toe shortest, shorter than fourth finger and fifth toe, respectively; tail strongly compressed (fig. 8), with a fin above and below, the outline of the fins being straight and nearly parallel, toward the tip tapering to a fine point, which is drawn out as a soft filament nearly 4 mm. long; skin strongly and mostly transverse rugose, except on anterior portion of head, on limbs, and tail; a low, smooth, vertebral ridge from nape to tail, being contiguous with the upper fin of the latter and bifurcating on the occiput; parotoid gland large, prominent, compressed, flap-like, almost continuous with a dorso-lateral glandular ridge cut by transverse grooves into a series of bead-like glands; a similar ventro-lateral ridge from axilla to groin; a large, smooth, globular gland on each side of the neck at each end of the gular fold; a somewhat smaller and flatter but well-defined circular gland above the insertion of the fore leg between the latter and the dorso-lateral ridge; vent a longitudinal slit surrounded by a large, globular swelling, the surface of which is coarsely pustular, the pustules near the posterior end of the vent being drawn out into long, pointed, conical papillæ. Color (in alcohol), above, uniform blackish brown; below, including the edge of upper lip, ventro-lateral ridge, and the anterior portion of the lower edge of the tail, yellowish white, with a series of irregular blackish blotches on each side of the belly and a few paler ones unsymmetrically on throat and fore neck; underside of hands and feet, dusky.



Figs. 7-8.—Diemictylus pyrrhogaster. 2 × nat. size; 7, underside of head; 8, section of tail at end of basal third. No. 6272, U.S.N.M.

Dimensions.

	mm.
Total length	93
Tip of snout to gular fold	12
Gular fold to anterior angle of vent	32
Anterior angle of vent to tip of tail exclusive of filament	47
Length of caudal filament	4
Width of head	10
Fore leg	18
Hind leg	20
Longest toe	7
Height of tail in the middle	7

The *adult female* (U.S.N.M. No. 31894; Kochi, Shikoku; May 11, 1903, Dr. Hugh M. Smith, collector) is larger, total length being 123 mm., and differs from the breeding male in the lesser development of the parotoid glands as well as the lateral glandular ridges, absence of the scapular gland, and the caudal filament. The body is also longer, the distance from tip of snout to gular fold being contained more than three times in the distance from gular fold to vent; so that the fingers and toes barely touch when the limbs are pressed against the side, the toes themselves also being shorter than in the male; finally, the vent is quite different, being a nearly circular opening with long radiating papillæ forming an oval swelling on a compressed elevated base.

The *nonbreeding male* and *female* (U.S.N.M. Nos. 30735, 30736; Miyazaki, Kiusiu) differ from the breeding ones chiefly in the lesser development of the glands and of the papillæ surrounding the vent, the male also by the absence of the caudal filamentous appendix.

Color of living specimens.—Dr. Hugh M. Smith has kindly furnished the following note on the color of the living specimens collected by him in Kiusiu and Shikoku during the breeding season. The back is black or blackish green; the underside of head, body, legs, and tail is blood red, with dark green mottling or streaks inclined to be symmetrical. In some specimens the back is lighter green and the sides of the tail may be steel blue.

Variation.—The chief variation is in the amount of dusky or blackish color on the underside. The normal markings seem to consist of a series of irregular spots on each side of the belly sometimes confluent to longitudinal streaks. These markings are often so heavy as to make the sides nearly uniform black, but the center of the belly is usually unspotted. On the other hand, some specimens are nearly devoid of spots. These form Krefft's variety *immaculiventris,* but they are not confined to any particular locality and represent only the extreme individual variation.

A male specimen taken in May, 1898, near Mount Fuji (U.S.N.M., No. 34308), is of a light grayish brown, almost unspotted underneath and seems to be a sort of albino.

Boulenger and Wolterstorff (Zool. Anz., XXX, 1906, p. 562) express the opinion that a more detailed study of *D. pyrrhogaster* might show the desirability of breaking it up into several subspecies, and the former mentions several breeding males and females from the island of Iki as being very small, as well as some Kobe specimens as having very weak parotoid glands. Whether the former island contains a particular dwarfed race it is impossible to say, as no measurements are given, but I do not believe it will be possible to split the specimens inhabiting the various large islands into geographical forms. The size and prominence of the parotoid glands seem to be more or less dependent on the season.

Habitat.—Widely distributed and common, inhabiting streams, ponds, reservoirs, and roadside drains, but probably confined to the lower altitudes.

Siebold[a] reported it from Hondo and Shikoku as well as from Kiusiu. Doctor Fritze has stated that he found no specimens in Yezo, but that he saw some in the Sapporo Museum. Doctor Nozawa, however, has emphatically asserted (in letter dated February 27, 1901) that this is a mistake, that "there is no record of its presence [in Yezo] and, moreover, no specimen in the Sapporo Museum."

There are numerous specimens from Nagasaki in the various museums—for instance, in British Museum, the Hamburg Museum, and Museum Senckenbergianum. The United States National Museum has it from Miyazaki, province of Hiuga, Kiusiu, and Dr. Hugh M. Smith reports having observed it in the province of Satsuma.

The latter gentleman collected a fine series at Kochi, province of Tosa, Shikoku.

From Hondo we have numerous records. Thus, from Tokyo, Kyoto, Kaga, and Suwa (Okada); from Yokohama (von Martens; Mus. Senckenberg), Hakone (Indian Mus.; Hilgendorf), Tokyo, and province of Kazusa (Hilgendorf), Lake Biwa (Indian Museum). Jouy collected it on the way between Yokohama and Kobe, and the *Challenger* expedition brought home specimens from the latter place. In the Hamburg Museum there are specimens collected by T. Lenz in Kawachi Province, and Prof. R. Hitchcock sent us a specimen from Osaka. Dr. Hugh M. Smith collected three fine specimens in spring ponds near Kyoto and observed the species in the provinces of Ise and Shima, and from Mr. A. Owston we have a large series collected at Mount Fuji. Finally, British Museum has two specimens from "northern parts of Niphon."

There is no record of this species from Tsu-shima, but specimens from Iki-shima, between the latter and Kiusiu are in British Museum.[b]

It would be highly interesting to know how far north this species goes in Hondo and also what its distribution is on the west coast. It is also of the greatest importance that its vertical range in the various provinces should be ascertained and recorded.

Diemictylus pyrrhogaster is said to occur in China, but the alleged Chinese specimens of this species are either of very dubious origin[c] or else belong to the Chinese representative, *Diemictylus orientalis* David[a] recently redescribed by Woltersdorff.

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[a] Introd. Rept. Fauna Japon., p. xvi.

[b] Boulenger, Zool. Anz., XXX, 1906., p. 562.

[c] Thus the specimen in the museum in St. Petersburg referred to by Strauch (Mém. Acad. Sci. St. Pétersbourg, (7) XVI, No. 4, 1870, p. 51) and obtained from Doctor Schaufuss, the Dresden dealer, who was unable, however, to guarantee the correctness of the locality. The habitat "China" is the more suspicious in this case, as the museum in question also has a specimen of *Hynobius nævius* from the same source and same alleged locality. (See Strauch, same reference as above, p. 55.)

Another nearly related species, *Diemictylus sinensis* (Gray) is also a native of China, the type having been collected "inland of Ningpo." Boettger mentions four specimens from Hongkong in Museum Senckenbergianum. For difference from *D. pyrrhogaster* consult Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 100.

Lately a third species has been discovered at Yunnan fu, province of Yunnan, at an elevation of about 6,000 feet, namely, *Molge wolterstorffi* Boulenger.[b]

List of specimens of Diemictylus pyrrhogaster.

U.S.N.M. No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Total length.
					mm.
6272*a*	Male[a]	Japan			80
6272*b*	do	do			88
6272*c*	do	do			87
6272*d*	do	do			83.5
6272*e*	Female	do			98
14865	do	Osaka		R. Hitchcock	114
17811	Male	Kobe to Yokohama	Aug. —, 1886	P. L. Jouy	78
17812	Female	do	do	do	111
30735	Male[b]	Miyazaki, Kiusiu		C. A. Clark	77.5
30736	Female[b]	do		do	92.5
30737	do	do		do	88.5
30738	do	do		do	81
31794	do	Kyoto, Hondo	Apr. 20, 1903	H. M. Smith	98
31795	Male	do	do	do	93
31796	do[c]	do	do	do	93
31894	Female[b]	Kochi, Shikoku	May 11, 1903	do	123
31897	do	do	do	do	113
31898	do	do	do	do	104
31899	do	do	do	do	109
31900	Male	do	do	do	83.5
31901	do	do	do	do	89
34288	Female	Mount Fuji, Hondo	May, —, 1898	A. Owston	119.5
34289	do	do	do	do	126
34290	do	do	do	do	116
34291	Male	do	do	do	104
34292	do	do	do	do	100
34293	Female	do	do	do	118.5
34294	do	do	do	do	122
34295	Male	do	do	do	100
34296	Female	do	do	do	116
34297	Male	do	do	do	101

[a] Figs. 7–8. [b] Description, p. 18. [c] Description, p. 16

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[a] *Triton orientalis* DAVID, Jour. Trois. Voy. Emp. Chinois, I, 1875, p. 32 (type-locality, Kiontchéou, Prov. Che-kiang, China); II, pp. 215, 238 (Tsitou, Prov. Kiangsi) (types in Paris Mus.).—*Triton pyrrhogaster* subsp. *orientalis* WOLTERSTORFF, Zool. Anz., XXX, Aug. 28, 1906, p. 558; Abh. Mus. Magdenburg, 1906, p. 153, pl. I, figs. 3–6 (Chee-chou, Prov. Hupeh).

[b] Proc. Zool. Soc. London, 1905, I, p. 177, pl. XVII.

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The Morphology of Coeloplana.

By

Prof. **James Francis Abbott.**

(Washington University, Saint Louis, Missouri, U. S. A.)

With plates 8—10 and 7 figures in the text.

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The following account deals with the details of structure and homologies of "*Coeloplana*", a form hitherto known only from a superficial description of a single specimen. The material for the present paper was described in a preliminary note in: Annotationes Zoologicae Japonenses. Vol. 4. 1902, but press of other duties has made it impossible to complete the work until now.

A. Historical.

1. Kowalevsky's *Coeloplana*.

In 1881, Kowalevsky discovered in the Red Sea near the city of Tor, a form to which he gave the generic name *Coeloplana*[1]), in allusion to the apparent combination of Coelenterate and Planarian characters which it afforded. Kowalevsky's report was published in the proceedings of the Zoological Section of the Sixth "Convention of Russian Naturalists and Physicians".[2]) It was reviewed in the "Zoologischer Anzeiger", and our knowledge hitherto has depended upon this latter rather brief account. The Russian naturalist described his single specimen as grayish above and white ventrally, round in outline and measuring about three lines in one direction by two lines in the other. It was found on Zostera at a depth of 10 to 15 fathoms and was mistaken for a planarian until his attention was attracted by the extrusion of the tentacles. The abstract in the Zoologischer Anzeiger describes *Coeloplana* as ciliated all over and Kowalevsky's figure shows cilia all about the periphery but he makes no such statement in the original paper. The animal was described as "Planarian-like". There was a median ventral mouth leading directly into a central gastric cavity from which branching canals ramified. Four main divisions led off from the central cavity and divided up into many subdivisions. separated by trabeculae connecting the upper and lower body walls. These canals according to Kowalevsky opened into a circum-peripheral canal from which extended blind processes. Above the mouth was a Ctenophor-like otolith sac with its enclosed otolith. On either side surrounding it, were two curious half moon shaped diverticula of the gastric cavity.[1])

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[1]) According to the strict rules of nomenclature the spelling "*Coeleplana*" should be retained, but as the spelling "*Coeloplana*" has been used constantly since Kowalevsky's paper and for orthographic reasons is so very much to be preferred, it has seemed best to continue its use in the present paper.

[2]) Извѣст. общ. люб. естествоз. Vol. 43. Труды. зоол. отдѣла. Vol. 1.

In the opposite plane were the characteristic Cydippid tentacles each enclosed in a flask-shaped sheath.

Notwithstanding its Planarian-like appearance KOWALEVSKY concluded that so far as his rather superficial examination went, *Coeloplana* was more Ctenophore than Flatworm. He considered the plane of the tentacles as right and left, that is, sagittal.

2. KOROTNEFF'S *Ctenoplana.*

Some four years later, another Russian scientist, ALEXIS KOROTNEFF, caught in the tow-net, on the west coast of Sumatra, a single specimen of an animal that was very evidently closely related to *Coeloplana* but presenting marked points of difference. This form was much more like a typical Ctenophore than *Coeloplana* and to it KOROTNEFF gave the name *Ctenoplana*. In addition to the characteristic otolith and tentacles which had been described for *Coeloplana*, KOROTNEFF also described eight rows of Ctenophoral costae, the individual combs of which, however, were reduced to seven in number. Each costal row was retractile into a cup-shaped cavity of the body wall. The rows of costae were separated in one plane by the tentacle sheathes and between the other rows the body was thrown up into folds, — the whole effect being to give a stellate appearance tothe dorsal surface. In KOROTNEFF'S figure there is a notch in the periphery on either side, in the plane at right angles to the tentacular plane.

About the otolith was a circlet of sensory tentacles (11 in his figure) and the whole body surface is described at ciliated. KOROTNEFF described and figured the structure of the otolith and its cup in some detail. According to him the mouth leads directly into a central cavity from which the gastric canals arise, and above which there is a structure like the Ctenophor infundibulum, consisting of a cup-shaped cavity just below the otolith sac. The presence of any circumperipheral canal is denied. He also described a remarkable structure in the neighborhood of the tentacles, — a cavity in which lie large and powerful longitudinal muscles and which opens to the exterior by a pore. He conceives this to be possibly excretory in function, and surmises that it may be homologous with the water-vascular system of Planarians. However, as Willey suggests, there is no doubt that Korotneff was describing a section through the tentacles, which he was unable to orient correctly. The muscular fibers of the tentacle stalk might well be mistaken for "longitudinal muscles".

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[1]) The abstract in the Zoologischer Anzeiger reports these: "Vor und hinter diesem Bläschen (i. e. the otolith) gewahrt man die erweiterten scheinbar blinden Enden zweier Canäle, die vom Magen ausgehend gegen die dorsale Körperfläche gerichtet sind". The obvious but misleading interpretation of this statement seems to have lead LANG astray in one of his homologies. Vide post.

3. Willey's *Ctenoplana.*

No further discoveries of either *Ctenoplana* or *Coeloplana* were reported until Arthur Willey, in 1896, in the course of his investigations in the South Seas, discovered 4 specimens of Korotneff's *Ctenoplana,* apparently belonging to different species, three of the specimens being greenish and one crimson. Willey was able to keep them under observation in the living state some time and established the fact that *Ctenoplana* swims through the water as a Ctenophore does, solely by the aid of its costae. The most important contribution that he was able to add to the morphology of the form was the discovery of the male gonads, which are described as being located "at the bases of the two end-lobes of the main portion of the gastro-vascular system" and hence apparently radially disposed in relation to the otolith.

The most striking thing in Willey's description is that these gonads open to the exterior, dorsally, by one or more simple ducts the mouths of which lie just below the level of the surmning plates. The cell proliferations which constitute the testis are developed upon the outer walls of the coeca from the gastric canals. The whole arrangement is strikingly at variance with anything we are familiar with in either Coelenterates or Platyhelminthes. Willey asserts that the dorsal surface bears no cilia. He further states that the sensory tentacles near the apical sense organ, instead of forming a closed circle, as described by Korotneff in reality are arranged in two semicircular areas on either side of the otolith sac, — the circle being broken in the line of the tentacular plane. Willey's figures are unsatisfactory inasmuch as he does not attempt to trace the course of the gastric canals. As far as one can make out, the costae, as figured, seem to lie between large, lobed diverticula of the central gastric cavity, in contrast to the condition usual in Ctenophors, in which the rows of costae overlie the meridional canals.

WILLEY's discoveries led him to institute some interesting homologies and hypotheses which will be taken up further on.

B. The Japanese *Coeloplana.*

In the summer of 1901 it was the writer's good fortune to discover, at Misaki, Japan, some specimens of what were very evidently KOWALEVSKY's "*Coeloplana*". Devoting himself the next summer to a renewed search he was further rewarded by finding several more, and altogether, that year and the next, some thirty or more specimens were obtained, some of which, however, were lost in aquaria and through poor fixing agents. The Coeloplanae were all obtained from two localities facing the open bay each a few square rods in area. One of these was the rocky beach immediately fronting the Marine Station and the other below the place known locally as "Dojin no Haka". Both these areas are covered with broken rocks and boulders and are exposed to rather high surf in rough weather. At the times of lowest tides the Coeloplanae may be found at a depth of about two feet, clinging to the small coralline covered stones on the bottom, but they are very rare even in the most favorable localities, and the hunt for them is frequently discouraging. Apparently the animals are never to be found in a tidepool where the water might be left by the receding tide and grow stale or warm in the sun's rays. Two species occured together, one a bright pink or red in color and the other smaller and chocolate brown. The two were found together in the same locality but always so situated as to make detection extremely difficult, owing to the resemblance between the animal and the stone or alga upon which it was fastened. I have never seen them floating or caught them in the tow-net but they have always been extended on the surface of the stone and fastened by slime so that they tenaciously resisted being taken off, and it was usually found more satisfactory to bring the stones into the laboratory when possible, and carefully force them off with a pipette. The Coeloplanae are found frequently on large rocks, stretched out into a thin shapeless film of slime hardly suggestive of anything animal. Such a specimen so extended may measure 5 or 6 cm across in longest diameter, shrinking to one-fifth that diameter when contracted.

1. Life habits.

Coeloplana cannot swim, either as a ctenophore, or by means of the flattened skirt of the body, as some planarians do. I have never found it floating, but in the quiet of the aquarium it usually came to the top and spread itself out, adhering to the surface of the water by the ventral face of the body, as a planarian. In this habit of floating it seems to resemble WILLEY's *Ctenoplana*. At such times *Coeloplana*, especially *C. mitsukurii*, throws out its long delicate tentacles which hang down in the water and wave about in very graceful fashion, and then the great length of the tentacles in comparison with the size of the body is made apparent (Fig. 2). If disturbed when so floating, — either by the water being agitated or by the body being touched by a foreign substance, — it falls to the bottom in a shapeless lump. WILLEY describes his *Ctenoplana* as folding together like a book under such circumstances, but there is no such axis of flexure in *Coeloplana*. If dropped, dorsal side uppermost, it rights itself without difficulty. Many experiments and observations were made to ascertain whether the animal crawled in any one direction rather than in another, and it was proved conclusively that it did not. The act of crawling seems to be wholly a response to peripheral stimuli and as such stimuli may act on two or more sides at once, we have the remarkable spectacle of two sides of the animal progressing in different directions. As noted by KOWALEVSKY this mode of progression is, in a sense, amoeboid. A projection of the body is pushed out and the rest of the body tissue behind it, follows on. When the animal is crawling, the whole periphery of the body is thrown into folds and outpushings. This is especially to be noted in the red form, *C. willeyi*, where no consistent body shape is maintained and where different sections of the body may overlap each other. One result of such a habit is that the internal structures become twisted about so as to defy orientation. When the animal is very active it will often, while crawling, throw out the tentacles in a cloud of white filaments. The whole mass of filaments seems to be expelled at once and then to be slowly withdrawn. The ejection of the tentacles is effected by a sudden contraction of the muscular walls of the sheath. The two tentacles

THE POLYPLACOPHORA OF TASMANIA.

By W. L. May and W. G. Torr, LL.D., Etc.

(Read May 13, 1912.)

Pl. I.

Recent dredgings and other excursions in connection with the Tasmanian Field Naturalists' Club, but more particularly an extensive examination of the North-West Coast by W. G. Torr, have introduced us to many species not previously known from Tasmania. In addition, much knowledge has been acquired respecting the distribution of forms already recorded, so that the time seemed opportune to bring out a new and up-to-date list, which we believe will be of distinct value to students of this interesting group. We have here increased the Tasmanian list to 32 species, including two new ones. It will be noticed that on comparing our list with previous ones, several names disappear, either because we consider there was a wrong identification, or because we cannot confirm the record, believing that a mistake was made.

"The Census with Brief Descriptions of the Marine Shells of Tasmania, and the Adjacent Islands," by the Rev. J. E. Tenison-Woods, read March 13, 1877, before the Royal Society of Tasmania, contains the following list of Tasmanian Polyplacophora on p. 46 of the Papers and Proceedings of the Royal Society of Tasmania for 1877 :—

1. *Chiton* (*lophyrus*) *australis*. Reeve.
2. *Chiton* (*lepidopleurus*) *liratus*. Ad. and Ang.
3. *Chiton* (*lepidopleurus*) *speciosus*. Ad. and Ang.
4. *Chiton piceus*. Gmel.
5. *Chiton proteus*. Reeve.
6. *Chiton sinclairi*. Gray.
7. *Chiton glaucus*. Gray.

8. *Chiton (planifora) petholatus.* Sby.
9. *Chiton (acanthochœles) zelandius.* Quoy.
10. *Cryptoplax gunnii.* Reeve.
11. *Cryptoplax spinosa.* H. Adams.

In 1901 Professor Ralph Tate and W. L. May published a revised census of the Marine Mollusca of Tasmania in the Proceedings of the Linnean Society of New South Wales, 1901, Part 3, July 31: pp. 412—415. In this census Tenison Woods' eleven chitons were extended to twenty-four species:—

1. *Lepidopleurus inquinatus.* Reeve.
2. *Lepidopleurus matthewsi.* Pilsbry.
3. *Callochiton inornatus.* Ten.-Woods.
4. *Ischnochiton crispus.* Reeve.
5. *Ischnochiton fruticosus.* Gould.
6. *Ischnochiton carinulatus.* Reeve.
7. *Ischnochiton contractus.* Reeve.
8. *Ischnochiton tateanus.* Bednall.
9. *Ischnochiton smaragdinus.* Angas.
10. *Ischnochiton novæ-hollandiæ.* Reeve.
11. *Haploplax mayii.* Pilsbry.
12. *Callistochiton antiquus.* Reeve.
13. *Plaxiphora petholata.* Sby.
14. *Plaxiphora glauca* Quoy and Gaimard.
15. *Acanthochites asbestoides.* Smith.
16. *Acanthochites bednalli.* Pilsbry.
17. *Acanthochites granostriatus.* Pilsbry.

18. *Acanthochites costatus.* Ad. and Ang.
19. *Acanthochites speciosus.* H. Adams.
20. *Cryptoplax striatus.* Lamark.
21. *Chiton jugosus.* Gould.
22. *Chiton pellis-serpentis.* Quoy et G.
23. *Loricella angasi.* H. Adams.
24. *Liolophura gaimardi.* Blainv.

1. LEPIDOPLEURUS INQUINATUS (Reeve).

Chiton inquinatus, Reeve: Conch. Icon, sp. 154, Pilsbry, Man. Conch, Ser. I., Vol. XIV., p. 90.

Lepidopleurus liratus, H. Adams and Angas: Proc. Zool. Soc., 1864, p. 192, Pilsbry, Man. Conch., Ser. I., Vol. XV., p. 101.

The type specimen of this shell was said by Reeve to be taken in Tasmania, and is now, according to Tate and May, in the British Museum. Bednall, in Proc. Mal. Soc., London, Part 4, April, 1897, p. 141, describes it as "a small elongated species, ornamented dorsally with fine, longitudinal, microscopically—closely—beaded riblets, which become coarser and somewhat divergent on the side slopes and with the terminal and lateral areas concentrically sulcate, the lateral areas especially so."

Some large specimens, length 16 m.m., breadth 7 m.m., were dredged by W. L. May from fifteen fathoms in Geographe Strait, East Coast of Tasmania. Smaller specimens were dredged in nine fathoms off Pilot Station, River Derwent. No specimen, to our knowledge, has been taken near the shore.

The large specimens dredged show the lateral areas distinctly raised, and have irregular strongly-marked concentric growth lines, about ten in number.

2. LEPIDOPLEURUS MATTHEWSIANUS. (Bednall.)

L. matthewsianus.—Bednall and Matthews, Proc. Mal. Soc., Lon., Vol. VII., Part 2, June, 1906, p. 92.

This shell, so common in South Australian waters, has been represented by only one specimen, discovered by W. L. May, near Devonport. It is very similar to *L. inquinatus*, but the lateral, pleural, and dorsal areas can only be separated by the direction of the granulations. The foot of this chiton is always of a sanguinary hue. Length, about 6 m.m., breadth 2 m.m.

3. LEPIDOPLEURUS COLUMNARIUS (Hedley and May.)

L. columnarius. Hedley and May. Records Aus. Mus., Vol. VII., No. 2, 1908, p. 123.

One perfect specimen and several valves were dredged from 100 fathoms, seven miles east of Cape Pillar. It differs from *L. inquinatus*, in that "*L. columnarius* lacks colour, has a more prominent mucro, longer and more arched valves, the granules are sharper, and their radial arrangement more distinct."

4. CALLOCHITON PLATESSA (Gould.)

Chiton platessa, Gould: Proc. Boston Soc. Nat. Hist., Vol. II. (1846), p. 143; Pilsbry, Man. Conch., Ser. I., Vol. XIV., p. 49.

Eleven specimens of this interesting chiton were collected at Burnie, Devonport, Stanley and Ulverstone, on the North Coast of Tasmania, by W. G. Torr. The delicate shagreening of the whole of its area and the slight ridge between the pleural and lateral areas make this specimen easily separated from others. Some of the specimens are uniformly chocolate brown, others are variegated with pale yellow, irregularly blotched. The girdle is not so broad as *C. inornatus*, and has delicate flat elongated scales, while *C. inornatus* is more leathery. Length, 22 m.m., breadth 13 m.m. This species, though common in New South Wales, is rare in South Australian waters.

5. CALLOCHITON MAYI (Torr).

C. mayi, Torr: P. R. S., Tasm. 1912. Pl. I., fig. 5, 6, and 7.

This remarkable and very distinct species is, so far, only known from the unique type, which will be preversely striated band, limited by a transverse ridge, below which the (vertical) surface is shining except at sides, but in the middle, at the top of the vertical face, is a large deep triangular pit; tegulæ piceous. Wings slightly dusky, nervures and the lanceolate stigma rufo-fuscous; b. n meeting t.-m.; second s.m. broad, receiving first r. n. at or before middle; third s.m. receiving second r. n. not very far from end. Legs with glistening white hair, pale reddish on inner side of tarsi. Abdomen shining, the weak punctures not dense; hind margins of second and following segments very narrowly reddish; no hair-bands; hair at apex fuscous; venter with pure white hair.

Hab. Yallingup, S.W. Australia, Sept. 14–Oct. 31, 1913, 2 ♂ (*R. E. Turner*). British Museum.

Related to *P. chalybeatus* and *P. obscurus*, but differing in various details. The metathorax is peculiar.

VII.—*Descriptions and Records of Bees.*—LXII.

By T. D. A. Cockerell, University of Colorado.

Parasphecodes excultus, Cockerell.

Mt. Wellington, S. Tasmania, Jan. 15–Feb. 6, 1913 (*R. E. Turner*). Brit. Museum.

Parasphecodes wellingtoni, sp. n.

♀.—Length $8\frac{1}{2}$–$10\frac{1}{2}$ mm.

Robust; head and thorax black; abdomen bright chestnut-red, first segment black or blackish at base, the limits of the dark patch not sharply defined, apical segments variably suffused with dusky; clypeus shining, more or less flattened or depressed in middle, very sparsely punctured; face glistening, but not smooth; front dull, more or less glistening at sides; the very scanty pale hair of face and cheeks more or less brownish; antennæ black, flagellum obscurely brown beneath; vertex, mesothorax, and scutellum with thin dark reddish-fuscous hair; fringe of tubercles pale ochreous; mesothorax strongly grooved in middle, dull in front, shining on disc, with small punctures of two different sizes; scutellum shining, with scattered minute punctures; postscutellum entirely dull, strongly contrasting with scutellum; area of metathorax dull, granular in middle, at sides with a weak reticulate sculpture; truncation of metathorax without projecting lateral points above; tegulæ dark rufous clouded with fuscous. Wings very red, nervures and stigma ferruginous; first r. n. entering second s.m. near apex, or meeting second t.-c. Legs black, anterior tibiæ variably red in front, but the colour never very bright; hind tibiæ and tarsi more or less strongly red, especially on inner side; hair of hind tibiæ pale reddish, sometimes fuscous on posterior margin. Abdomen with short fuscous hair at apex; venter with shining white hair, long on second segment, more or less fuscous toward the apex.

Hab. Mt. Wellington, S. Tasmania, Jan. 15–Feb. 6, 1913 (*R. E. Turner*), 4 ♀. Brit. Museum.

The specimens come from an altitude of 1300–2300 feet. Among Smith's species this is nearest to *P. lithusca*, but differs by the dark legs. It is quite distinct from all the species described in recent years.

Parasphecodes turneri, sp. n.

♀.—Length about 8½ mm.

Robust; head and thorax black; abdomen deep chestnut-red, first segment all red; a blackish stain about caudal margin; hair of head and thorax thin, black on clypeus, vertex, mesothorax, and scutellum, also at sides of front, but otherwise rather dull white; mandibles dark red at apex; clypeus and supraclypeal area brilliantly shining, sparsely punctured; front dull, glistening at sides; antennæ entirely black; mesothorax entirely dull and granular, under the compound microscope seen to be extremely densely confluently punctured; scutellum bigibbous, rough, the elevations shining; area of metathorax strongly longitudinally grooved, sharply truncate behind, the lateral posterior corners forming obtuse angles; tegulæ black. Wings dusky, but scarcely at all reddened; nervures and stigma sepia; first r. n. entering apex of second s.m. Legs black, with glittering white hair, but black or fuscous on outer side of tibiæ. Abdomen with fuscous hair at apex; hair of venter entirely white.

♂.—Length about 8 mm.

Similar to the female, but less robust, though not slender; mandibles with no yellow spot; labrum dark; clypeus with a broad apical pale yellow band, with a small pointed projection on its upper side in middle; flagellum long, dull red beneath; abdomen black beyond the third segment, and with a round black spot on each extreme side of third near base; legs without red or yellow markings.

Hab. Eaglehawk Neck, S.E. Tasmania, Feb. 12–March 3, 1913 (*R. E. Turner*). 1 ♀ (=type), 1 ♂. Brit. Museum.

The male may be compared with *P. altichus*, Sm., but it has no black cloud on third abdominal segment, and the disc of thorax is not strongly punctured. The female is not much like any described species.

Parasphecodes recessus, sp. n.

♀.—Length about 9 mm.

Robust; head, thorax, legs, and antennæ black; abdomen shining, dark chestnut-red, first segment dorsally black except the very broad apical margin, apical segments red; second segment with a small and third with a large black spot on each extreme side near base; mandibles black, with an obscure subapical red band; clypeus shining, sparsely punctured; hair of head and thorax scanty, white on sides of thorax, pale ochreous on vertex and dorsum of thorax, mixed with fuscous on scutellum; mesothorax deeply grooved in middle, dullish, with fine weak punctures which become well separated on disc (under the compound microscope the punctures are seen as minute elevations surrounded by depressions, and the space between them is minutely and weakly tessellate); scutellum somewhat bigibbous, sculptured like mesothorax; area of metathorax with irregular fine rugæ basally, running into an irregular reticulation and disappearing on the apical part, which has a microscopical tessellation; posterior truncation sharply defined, with projecting points at upper corners; tegulæ black. Wings somewhat dusky, not reddened, stigma and nervures red-brown; second s.m. broad; first r. n. meeting second t.-c. Hair of legs mostly yellowish white, fulvous on inner side of tarsi, dark fuscous on outer side of hind tibiæ and basitarsi. Punctures of abdomen excessively fine.

Hab. Mt. Wellington, S. Tasmania, Jan. 15–Feb. 6, 1913 (*R. E. Turner*). Brit. Museum.

Among Smith's species comes closest to *P. tilachus*, but fourth and fifth abdominal segments not black, &c. The sculpture of mesothorax is quite different from that of *P. speculiferus*.

Parasphecodes perustus, sp. n.

♂.—Length about 8 mm.

Rather slender; head and thorax black, with thin white hair, tinged with brown dorsally; legs black, with the tibiæ partly red (anterior ones red, with a dusky patch on outer side) and the long tarsi clear red; abdomen very bright ferruginous, with the apex strongly suffusedly blackened, first segment entirely red; mandibles red at apex; clypeus with a broad, transverse, lemon-yellow, apical patch, sending a long pointed projection upwards; supraclypeal area minutely roughened; scape very short; flagellum extremely long, clear ferruginous beneath; mesothorax and scutellum entirely dull and granular, the microscope showing excessively close punctures on a tessellate surface; area of metathorax small, finely longitudinally ridged, with a raised margin; posterior truncation without projections at upper corners; tegulæ rufous. Wings dusky hyaline, nervures and stigma rufo-fuscous; first r.n. meeting second t.-c.; third s.m. much broader above than second (in *P. recessus* they are about equally broad above). Legs with white hair. Dorsal suture between first and second abdominal segments depressed.

Hab. Mt. Wellington, S. Tasmania, Jan. 15–Feb. 6, 1913 (*R. E. Turner*). Brit. Museum.

Among Smith's species this may be compared with *P. altichus*, but it is quite distinct. It is much smaller than *P. froggatti*, with a brighter red and much less hairy abdomen.

The following table separates the above species of *Parasphecodes*:—

	Disc of mesothorax brilliantly shining, polished, with punctures of two sizes; scutellum brilliantly shining	*wellingtoni*, Ckll.
	Mesothorax and scutellum dull, or, if somewhat shining, punctures of disc of mesothorax not of two sizes	1.
1.	Abdomen black beyond the third segment	2.
	At least fourth segment red	3.
2.	Disc of mesothorax moderately shining, the punctures well separated and distinct under a lens; wings strongly reddened	*excultus*, Ckll.
	Disc of mesothorax dull, the punctures not separately visible under a lens; wings greyish, not reddened	*turneri*, Ckll., ♂.
3.	Red of abdomen very bright; tegulæ red	*perustus*, Ckll.
	Red of abdomen dark; tegulæ black	4.
4.	Area of metathorax strongly plicate all over	*turneri*, Ckll., ♀.
	Area of metathorax plicate only basally	*recessus*, Ckll.

Prosopis accipitris, sp. n.

♂.—Length 5 mm.

Black, not very robust, having the form and appearance of the common European species; mandibles cream-colour, the broad bidentate end slightly reddish; labrum, clypeus, broadly triangular supraclypeal mark, and lateral face-marks (narrow, leaving clypeal margin about middle, extending upwards, gradually narrowing to a point a considerable distance above level of antennæ) pale primrose-yellow; face narrowed below; clypeus very high, microscopically tessellate, with sparse very weak punctures; scape yellow in front, flagellum light ferruginous beneath; third and fourth antennal joints very short, about twice as broad as long; middle of front very densely microscopically punctured, with a honeycomb-like effect, the basins of the cells ridged or wrinkled; cheeks beneath tufted with white hair; mesothorax microscopically tessellate and with very minute weak punctures, not visible under a lens, which shows only a dull surface; tegulæ piceous, microscopically tessellate; tubercles and linear marks on upper edge of prothorax light yellow. Wings hyaline, nervures and stigma sepia; first r. n. entering second s.m. or meeting first t.-c. Anterior tibiæ and tarsi light rufo-fulvous, the tibiæ with a slight black mark behind; middle tibiæ with a pale yellowish stripe, their tarsi cream-colour, brownish apically; hind tibiæ with the basal third yellow, the rest black; their basitarsi yellowish white, pale reddish apically, but the other tarsal joints dark. Abdomen dullish, very finely sculptured, with very little hair.

♀.—Mandibles dark, the apex rufous; labrum dark; clypeus black, with a very broad, longitudinal, pale yellow band; lateral face-marks consisting of narrow bands along orbital margins; no supraclypeal mark; scape dark.

Hab. Eaglehawk Neck, Tasmania, Feb. 12–March 3, 1913 (*R. E. Turner*), 3 ♂ (one being the type), 3 ♀. Brit. Museum.

Prosopis perhumilis, sp. n.

♂.—Length about 4 mm.

Like *P. accipitris*, but considerably smaller; face broader above; lateral face-marks broad below, filling space between clypeus and eye; supraclypeal mark low and broad, its upper side flattened; scape with only a narrow light stripe. Wings dusky. Hind basitarsi black, with a little more than the basal third yellow. The sculpture of the front is as in *P. accipitris.*

♀.—Like that of *P. accipitris*, but smaller; hind tarsi entirely black.

Hab. Yallingup, S.W. Australia, Sept. 14–Oct. 31, 1913 (*R. E. Turner*), 6 ♂ (one of which is type), 3 ♀. Brit. Museum.

There are also two males labelled as collected by Turner on Mt. Wellington, Tasmania: is this, perhaps, an error?

These species run to 35 in my table of Australian *Prosopis*, but are distinct from the species there indicated and from allied ones subsequently described. *P. ancorata*, Ckll., shows many points of resemblance, but is easily separated by the cuneiform black marks on each side of clypeus and much more strongly sculptured mesothorax. *P. eburniella*, Ckll., has a much broader face than that of *P. perhumilis*, which it resembles somewhat in the markings.

Prosopis scintilla, Cockerell.

♂.—Length about 3½ mm.

Clypeus and long narrow lateral face-marks, ending acutely above level of antennæ, pale yellow (the precise tint doubtful, the specimen being altered by cyanide, but certainly not bright yellow); no supraclypeal mark; labrum and mandibles pale yellow; middle and hind tibiæ pale apically as well as basally; tubercles pale reddish.

Hab. Mackay, Queensland, March 1900 (*Turner*, 1082).

I had determined this as probably the male of *P. scintilla* before noticing that the collector had himself indicated it as such. In my table of Australian *Prosopis* (Ann. & Mag. Nat. Hist., Feb. 1910) this runs to 34, and runs out because of the absence of a supraclypeal mark.

Prosopis sanguinipicta, sp. n.

♂.—Length about 5½ mm.

Rather robust; black, marked with ferruginous (on abdomen) and deep chrome-yellow; head round, orbits converging below, but face quite broad; cheeks and anterior coxæ tufted with long pure white plumose hairs; mandibles, labrum, entire face below level of antennæ, swollen extension of supraclypeal mark between antennæ, and very broad upward extension of lateral marks (reaching nearly to level of anterior ocellus) all shining (as if newly painted) rich yellow; depressed lower part of supraclypeal area appearing as a shining crescent, the concavity upward; clypeus finely punctured, sides of face more coarsely; a pale yellow band along posterior orbits; scape thick, black above, ferruginous below; flagellum light ferruginous, strongly dusky above; mesothorax dullish, microscopically tessellate and shallowly punctate; scutellum and postscutellum black; tubercles and two short lines on upper border of prothorax yellow; coxæ and trochanters marked with pale yellow; femora black, the anterior and middle ones yellow in front, and apically above; anterior tarsi yellow, the others blackish, with light base; tegulæ small, rufo-testaceous. Wings dusky hyaline, nervures and stigma reddish-sepia; first r. n. meeting first t.-c., second joining second s.m. near apex. Abdomen broad, shallowly emarginate at apex; first segment red dorsally and along hind margin laterally; second segment with a reddish median patch.

Hab. Yallingup, S.W. Australia, Sept. 14–Oct. 31, 1913 (*R. E. Turner*). Brit. Museum.

A very distinct species, running in my table of Australian *Prosopis* to the vicinity of *P. rufipes*, Sm., but easily known from this and allied species by the deep yellow face-marks.

Gnathoprosopis rowlandi, sp. n.

♂.—Length about 5 mm.

Black, with yellow markings, largely reddened by cyanide in the type; face much narrower than in *G. hackeri*, wholly pale (light tan, but probably originally pale yellow) below antennæ, the lateral marks extending above with much the form of a hand with index-finger pointed (as in *G. euxantha*); scape very broad, dark above, wholly lemon-yellow below; cheeks wholly black; flagellum ferruginous beneath; prothorax with the thickened upper margin and the tubercles red, but evidently originally bright yellow; no other yellow on thorax; mesothorax extremely finely punctured. Legs yellow, with the coxæ and trochanters, the hind femora, and the other femora basally above, black; hind tarsi blackened apically; tegulæ piceous, with a rufous spot. Wings dusky hyaline, stigma and nervures fuscous; first r. n. meeting first t.-c. Abdomen broad, shining, finely punctured; third ventral segment with a pair of well-developed tubercles, but no ridge between.

Hab. Yallingup, S.W. Australia, Sept. 14–Oct. 31, 1913 (*R. E. Turner*). Brit. Museum.

Allied to *G. bituberculata* (Sm.), but differing in various details of coloration. Also allied to *G. euxantha* (Ckll.), from which it is known by the swollen scape and other characters. The mesothorax is much more finely punctured than in *G. hackeri*, Ckll.

Prosopis distractus, sp. n.

♂.—Length 6 mm. or slightly over.

Rather robust; black, with yellow markings (all turned red by cyanide in type); head broad for a *Prosopis*, the eyes little converging below; mandibles yellow, rather long, conspicuously bidentate at end; labrum yellow; a short indistinct yellow line on posterior orbital margin; face all yellow to level of antennæ, and lateral face-marks extending broadly upwards, then narrowing to a point on orbital margin above middle of front; clypeus broad, not especially high as in species of *Gnathoprosopis*, finely punctured; supraclypeal area large and long, depressed and shining, at its upper margin slightly elevated and bigibbous; upper extension of lateral face-marks shining and swollen; scape light in front, not swollen; flagellum light ferruginous beneath; mesothorax and scutellum dullish, microscopically tessellate and excessively minutely punctured; greater part of tubercles and slender interrupted line on upper border of prothorax yellow; no other yellow on thorax; thorax with an obtuse tubercle on each side beneath, in front of middle legs. Legs black, with the following parts yellow:—anterior coxæ and their trochanters beneath, small marks on hind coxæ, anterior femora beneath and at apex, middle and hind femora at apex, anterior tibiæ except a stripe behind, longitudinal band and ends of middle tibiæ, basal third of hind tibiæ, anterior tarsi, and basal part of middle and hind basitarsi; tegulæ ferruginous, with a yellow spot. Wings dusky hyaline, nervures and stigma dark sepia; first r.n. entering base of second s.m. Abdomen thick, moderately shining; third ventral segment with a strong transverse curved ridge, convex caudad, the ends not elevated into distinct tubercles.

Hab. Yallingup, Sept. 14–Oct. 31, 1913 (*R. E. Turner*). Brit. Museum.

Runs in my table nearest to *P. bituberculata*, which is a *Gnathoprosopis*. It is a singular species, with some of the characters of *Gnathoprosopis*, yet certainly to be excluded from that genus.

Euryglossa nubilipennis, sp. n.

♀.—Length about 9 mm.

Robust; head, thorax, and legs black; first three abdominal segments red, clouded with blackish, the first segment broadly dark basally, and dark apically except at sides, leaving on each side a transverse bright ferruginous subapical stripe, second segment with the posterior middle (broadest at centre) dark, third with a dark green band just before the dark fuscous marginal depressed portion; fourth and following segments dark green, with piceous apical margins, the fourth suffusedly reddish at lateral base; flagellum dull red beneath; tegulæ piceous. Wings somewhat dilute reddish fuliginous, nervures and the rather small stigma dark fuscous. Head broad; clypeus shining, with distinct but sparse punctures, the middle almost impunctate; mesothorax shining, irregularly punctured, very densely at sides, very sparsely on disc; scutellum with strong irregular punctures, and very minute ones between; area of metathorax shining, with an obtuse transverse ridge; the thin hair of thorax is mostly white, but greyish brown on vertex, and also brown, but very scanty, on mesothorax and scutellum; lower side of first s.m. strongly arched; second s.m. much broader (longer) than high, receiving the recurrent nervures not far from base and apex. Hind legs without any distinct pollen-collecting hairs; hind spur strongly pectinate. Abdomen broad, shining, very sparsely punctured; fifth segment with conspicuous black hair.

Hab. Mt. Wellington, S. Tasmania, Jan. 15–Feb. 6, 1913 (*R. E. Turner*). Brit. Museum.

Easily known from the species which it more or less resembles in the colours of the abdomen by the very dark wings.

VIII.—*New* Nasua, Lutra, *and* Proechimys *from South America.* By Oldfield Thomas.

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Nasua judex, sp. n.

N. dorsalis group. Sides tipped with fulvous, back obscurely dark-lined.

Size and skull-characters about as in *N. dorsalis* and *candace*, to the latter of which the new form is most nearly allied. General colour dark greyish, the tips of the longer hairs bright fulvous. Middle line of back darker, the hairs tipped with black, the darker area less marked

25. CRYPTOPLAX STRIATUS (LAMK), VAR. GUNNII.

Chitonellus gunnii, Reeve: Conch. Icon., sp. 5.

Cryptoplax striatus, var. *gunnii*, Pilsbry: Man. Conch. Ser. I., Vol. XV., p. 54.

This vermiform shell occurs commonly on the East and North-West Coasts. The first two valves are wider and more rounded than the others. These are narrower than the valves of *C. striatus*. The valves are long and narrow, and are embedded in the girdle, which is five or six times as large as the valves. The dorsal area is smooth, narrow, horny, and is sometimes smaller towards the middle than at each end. The ridges in the lateropleural area may be regular or irregular, sometimes (in young specimens) beautifully pustulose. The girdle is generally covered with seal-like hair. Some are leathery or smooth. These are probably worn specimens. Length of dried specimen, 45, breadth 9 m.m.

26. CHITON JUGOSUS, Gould.

Chiton jugosus, Gould: Proc. Boston Soc. Nat. Hist. II. (1846), p. 142.

Chiton concentricus, Reeve: Conch. Icon. (1847), sp. 95.

Specimens of this very beautiful true chiton have been found at Ulverstone, Burnie and Stanley, on the North-West Coast, and at Frederick Henry Bay, and the estuary of the Derwent, on the South Coast. It loves the smooth rocks in deep water, about 3 feet below low tide. The colour markings of the Tasmanian species are more like the South Australian specimens than those of New South Wales. In the Records of the Australian Museum, Vol. VII., No. 4, 1909, Hedley and Hull give an interesting comparison between *jugosus*, *torrianus* and *coxi*. Measurement: Length 49, breadth 24 m.m.

27. CHITON PELLIS-SERPENTIS. Q. et G.

Chiton pellis-serpentis, Q. and G., Voy. Astrolabe, III., 1835, p. 381, Pilsbry: Man. Conch., Ser. I., Vol. XIV., p. 173

This is the commonest of all the Tasmanian Chitons, and may be found crawling over the rocks everywhere, even up to high water mark. The distinct black wedge-shaped polished dorsal area distinguishes it from *C. sinclairi.* It is very often difficult to separate the two species. The growth lines of the central areas in *pellis-serpentis* are very distinct, and are crossed by numerous longitudinal riblets, which give the growth lines a nodulose appearance. Length 46, breadth 25 m.m.

28. CHITON TRICOSTALIS, Pilsbry.

Chiton (*canaliculatus* var. ?) *tricostalis*, Pilsbry: Nautilus, Vol. VIII. (1894), p 54.

This prettily marked and distinctive chiton was found at Devonport and Stanley, one being red, with creamy splashes, and the other olive green, with dark and white splashes. This shell is not uniformly three-ribbed—it sometimes has more, young specimens have only two. It must be searched for in clean pools in moderately deep water.

29. CHITON QUOYI, Deshayes.

Chiton viridis, Q. and G., Voy. Astrol, III., p. 383 (1834).

Chiton quoyi, Desh. in Lam , Anima, s. Vert., VII , p. 509 (1836).

Chiton glaucus, Hutton, Man. N.Z. Moll., p. 112 (1880).

This shell was in Tenison-Woods' Census of Tasmanian Shells, but was dropped by Tate and May in their census of 1901. It has been re-discovered in 1910 by W. L. May at Bellerive Bluff. It was referred to by May in his additions to the Catalogue of Marine Shells of Tasmania in the Proc. Roy. Soc. Tasmania, 1910, p. 310. It is uniformly dark olive green. Length 32, breadth 21 m.m.

30. CHITON CALLIOZONA, Pilsbry.

Chiton (*aereus* var.) *calliozona*, Pilsbry: Nautilus, Vol. VIII. (1894), p. 55.

In looking through Miss Lodder's collection, W. G. Torr discovered a median valve of this interesting and beautiful chiton. It is generally found on smooth stones in clear sandy pools, in deep water.

31. LORICELLA ANGASI (Ad. and Angas).

Lorica Angasi, H. Adams and Angas: Proc. Zool. Soc., 1864, p. 193; Pilsbry, Man. Conch., Ser. I., Vol. XIV., p. 238; Proc. Acad. Nat. Sci., Philad., 1894, p. 87.

This deep water shell has been found washed up on the North-West Coast by the late Miss Lodder, to whom we are both indebted for specimens. Anterior valves were collected on the beach at Ulverstone by W. G. Torr.

32. LIOLOPHURA GAIMARDI, Blainville.

L. gaimardi, Blainv. (Chiton), Dict. Sc. Nat.; Vol, 36, p. 546, 1825: Pilsbry, Man. Conch., XIV., p. 240, 1893.

This shell is reported from Kangaroo Point by W. F. Petterd, and W. G. Torr has one specimen in his collection. We have not been able to discover the species.

Fig. 1.—*Acanthochites lachrymosus,* May and Torr, n.sp. posterior valve.

Fig. 2.—*Acanthochites lachrymosus,* interior valve.

Fig. 3.—*Acanthochites lachrymosus,* median valve.

Fig. 4.—*Acanthochites lachrymosus,* portion of girdle.

Fig. 5.—*Callochiton mayi,* Torr, anterior median valve.

Fig. 6.—*Callochiton mayi,* interior of anterior valve.

Fig. 7.—*Callochiton mayi,* posterior valve, not disarticulated.

and the excretory pores, 2) the adhesive cells or colloblasts of the pinnate tentacles which are the unique character of the Ctenophora, 3) the otolith and 4) the ciliated rosettes, which are identical with those found in the Ctenophora, even to the number of cells composing them. The last two characters, especially the last, must be considered as vestigial structures reminiscent of a previous pelagic habit. The otolith, the essential organ for orientation in a free swimming Ctenophore, we would hardly expect to find developing in a sluggish littoral form like *Coeloplana* but its presence is explicable on the supposition that *Coeloplana* is descended from a pelagic form. The ciliated rosettes in the pelagic Ctenophores function without doubt as means for hastening the absorption of digested food substances into the mesogloea lying between the relatively widely separated gastric canals. In *Coeloplana* with its great reduction in amount of parenchyma due to the flattening out of the body, and the ramifications of the canal system, such organs must be almost functionless.

While the characters just mentioned have evidently been preserved unchanged in the adoption of a littoral habit, other structures have been modified in accommodation to that habit. The costae have disappeared. In *Coeloplana* the flattening of the body has also brought about attendant changes such as the vertical compression of the flaring proximal portion of the tentacle sheath to produce the "accessory sheath", the much greater development of the muscular system, the extensive anastomosing of the gastric canals and the conversion of the stomodaeum into a capacious pharynx.

A careful examination will also show how the arrangement of the gastric canals in *Coeloplana* may be merely a modification of the system in the Cydippida. It will be recalled that in a typical Cydippid the mouth opens into a long stomodaeum leading into an infundibulum from which branch out certain definite canals. Two of these, the perradial canals, lying in the tentacular plane, send off an interradial canal on either side and another one directed downwards, the stomodaeal canal, and are continued distally into the muscle of the tentacle as the tentacular canals. Each perradial canal divides in turn into two adradial canals that terminate in vertical expansions underlying the rows of costae. Complementary to the stomodaeum the infundibular canal leads upwards from the infundibulum to the base of the otolith, communicating with the exterior by the two excretory pores.

In *Coeloplana*, on account of the great flattening out of the body,

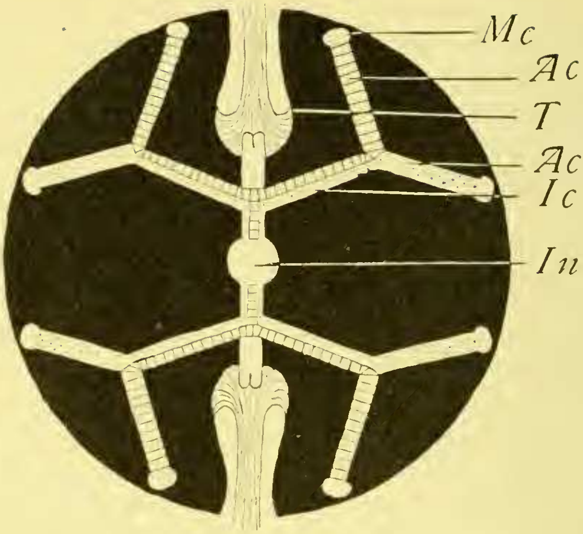

Fig. C. Diagram of canal system of Cydippid Ctenophor (after PARKER & HASWELL).
Mc Meridional canal. *Ac* Adradial canal. *T* Tentacle in sheath.
Ic Interradial canal. *In* Infundibulum.

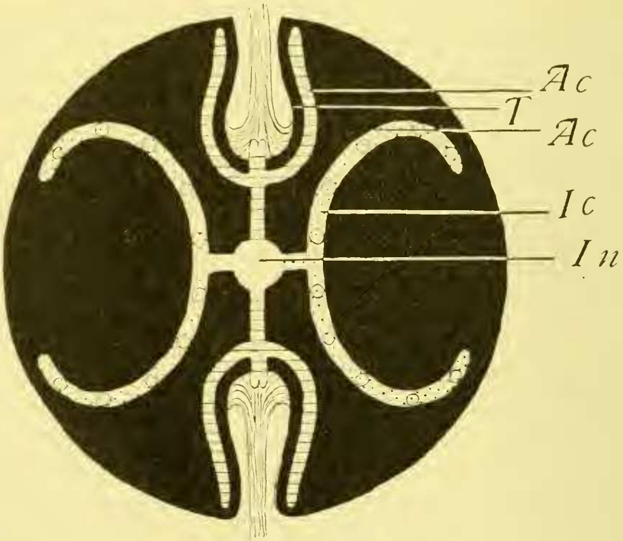

Fig. D. Diagram of canal system of *Coeloplana* showing the probable derivation from the Cydippid tyle.
Ac Adradial canal. *Ic* Interradial canal.
The dotted and striped regions represent similar portions of the canals in both figures. The interradial canals of Fig. C are supposed to be split to the infundibulum and united in the sagittal plane, the identity of the interradial canal being thus lost.

this infundibular canal has disappeared and the lower part of the stomodaeum has become modified as the pharynx. From the infundibulum the two perradial canals, as in the Cydippida, lead directly into the roots of the tentacles, but before entering the tentacle base they spread out in an enclosing network or system of sinuses surrounding the sheath, as described before. A glance at the text figures (C and D) will show the probable origin of all these "sinuses". We have only to imagine the stomodaeal canal bent upward and under the sheath (a natural result of the flattening of the body) and the splitting off of the adradial canals from the interradial canals to be continued down to the perradial canal and we would have the tentacle sheath enclosed on three sides by canals, the confluence of branches of which would give the enclosing network mentioned. The other two adradial canals would be left free and would run from the perradial canal to the periphery (Fig. D). In *Coeloplana* the proximal portions of these canals seem to have joined in the sagittal plane to form one one stem canal, which is, however, frequently cleft to the infundibulum (vide ante page 52). From these main trunks arise the anastomosing branches of the gastrovascular system as previously described. The Cydippid meridional canals have disappeared in *Coeloplana.*

D. Summary.

We may summarize the morphological facts described in the foregoing pages as follows:

1. The epithelium is similar to that in pelagic Ctenophores with the exception of the cilia on the ventral surface.
2. The epithelial gland cells apparently pass through the same cycle of changes as described by Samassa for the Ctenophores.
3. The coloration is due to iridocyte-like pigment cells in the subepithelial structures.
4. The gastrovascular system consists of a capacious thickwalled pharynx leading upwards into an infundibulum underlying the sense organ. From this two canals arise, in the tentacular plane, enclosing the tentacle sheathes in an anastomosing network. Two others in in the sagittal plane arise in the same way but soon divide so as to form four canals converging towards the tentacles, roughly in the form of a figure "8".
5. The arrangement of these canals has apparently been derived

from the Cydippid Ctenophore type by such an alteration of the Cydippid canal system as would naturally come about in the adoption of littoral habits by a pelagic form.

6. There is no circumperipheral canal and the multitude of small canals throughout the body are to be considered merely as arborizations of the main canals mentioned above.

7. The canals are lined with loose vacuolated endothelial cells that bud off into the lumen of the canals.

8. The pinnate tentacles with their "adhesive cells" (colloblasts) are practically identical with those of typical Ctenophores.

9. The method of formation of the colloblasts is as follows. The chromatin substance in the original mother cell arranges itself in a central mass, which we may call the nucleus and a number of smaller masses ("nucleoli") which arrange themselves in a hemisphere about the former. Each nucleolus cleaves off the adjacent cytoplasm into blocks (but without the formation of cell walls) so that the original cell has a mulberrylike appearance. This forms the cap of the cell. The cytoplasm differentiates into the spiral cord and the central filament of the developed cell and by its elongation the cell attains the shape and size typical of its kind. The "nucleoli" disintegrate leaving only the central nucleus at the base of the cup. The developed colloblast arises then from one undifferentiated cell and not from the union of two.

10. Phagocytes are to be found in the tentacle sheath, filled with the ingested fragments of colloblasts.

11. The otolith is typical of the Ctenophora and is supported by brushes of cilia arising from the wall of the cup.

12. There is a rudimentary nervous system with four ganglia symmetrically disposed about the otolith capsule.

13. The weight of the morphological evidence supports the assumption that *Coeloplana* is a very highly specialized Ctenophore related to, or derived from the Cydippida.1)

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1) The true position of *Coeloplana* and its relationship with other groups cannot be certainly decided until its development has been worked out. Unfortunately the writer has been unable to shed any light upon this matter. The only times when it was possible for him to collect were spring and late summer and it is possible that the animals attain sexual maturity at a different season or that they may reproduce at greater depths or in a different environment from that in which they were found.

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Explanation of plates.

Plate 8.

Fig. 1. Sketch from life of *Coeloplana willeyi*, on an Ulva frond. 10 : 1. The cylindrical dorsal respiratory tentacles are protruded: the armed tentacles retracted within their sheathes.

Fig. 2. Sketch from life of *Coeloplana mitsukurii* floating on the surface of the water. 2 : 1.

Fig. 3. A ciliated rosette viewed from the inner (parenchyma) side. 900 : 1. *m. c* muscle cell, *c. r* ciliated rosette, *c. t* "connective tissue cells".

Fig. 4. A colloblast or adhesive cell of the tentacles (*C. willeyi*). 1350 : 1. *n* nucleus of cap cell, *c* mulberrylike arrangement of cytoplasm of cap cell, *sk* skirt of cap cell, *sp* spiral filament, *f* central filament, *o. m* outer longitudinal muscle layer of secondary tentacle, *g. c* giant cell floating in interstices between muscle filaments of secondary tentacle. *tm* brushes or converging wedges of transverse muscle fibers, *i. m* inner layer of longitudinal muscles, *c. o* central core of the inner longitudinal muscles.

Fig. 5. Diagram to show insertion and relation of central and spiral filament to cap cell.

Fig. 6. Sketch from life of otolith region. ca. 20 : 1. Surrounding the otolith is a ring composed of cells that support the otolith. The outer yellowish ring is made up of the belt of gland cells of the cup. On account of their equatorial position they appear in surface view to be external to the band of supporting cells. Surrounding the lips of the depression are the branched pigment cells.

Plate 9.

Fig. 7. Section through epithelium, parenchyma and tentacle sheath of *C. mitsukurii*. 300 : 1. *ep* epithelium, composed of a syncytium of epithelial cells interspersed with gland cells, the latter in this preparation are in the beginning of "Stage C", *s. c* flagellate cells lining the tentacle sheath, *pig. c* pigment cell of the parenchyma, *m. b* group of muscle cells in cross section, *x* group of bodies of uncertain nature, possibly parasitic in nature. Interspersed in the parenchyma between the outer epithelium and that of the lining of the sheath are numerous isolated muscle cells and connective tissue cells. The former form a rather dense layer just under the epithelium.

Fig. 8. Ciliated rosette viewed from the side of the gastric canal, out of which it opens. 900 : 1. *ep* squamous epithelium lining the canal. *c. r* ciliated rosette.

Fig. 9—13. Cellular elements floating in the circulating fluid of the canal system. 900 : 1. Fig. 9, 11 and 13 show the typical forms resulting from coalescence of several cells. Compare with figure 39, plate 5.

Fig. 14. Cross section through skirt of *C. mitsukurii* near periphery. 300 : 1. *g. can* cross section of a gastric canal. Note the contrast between the secreting and non-secreting portions of the endothelial lining. Between the epithelium and the canals is a loose parenchyma made up almost wholly of branched connective tissue cells.

Fig. 15. Horizontal section (slightly tangential) through otolith capsule. *C. willeyi.* 160 : 1. *cav* cavity of the capsule, *gl* a few gland cells of the glandular zone, *nv* ganglia and nervous investment of the surface of the capsule, *in* cavity of the infundibulum which underlies the capsule and comes up about its sides. It is included in this section owing to the fact that the section is not cut quite horizontally.

Fig. 16. *C. mitsukurii.* Vertical section through a dorsal respiratory tentacle (quite strongly contracted). 365 : 1. *ep* dorsal epithelium, *p. c* pigment cells of parenchyma, *en* endothelial lining of gastric canals, *g. can* diverticulum of gastric canal entering the tentacle and branching with it. Numerous cross sections of muscle bundles are to be seen in the parenchyma as well as numerous long independent muscle cells.

Fig. 17—21. Cell elements of the parenchyma. 900 : 1. Fig. 17 and 21 ; typical connective tissue cells with forked processes found where the parenchyma is loose and spongy (cf. Fig. 24). Figs. 18 and 20, connective tissue cells found in denser parenchyma; Fig. 20 is possibly a type of an early stage of development. Fig. 19 is a solitary muscle cell such as is found throughout the parenchyma.

Fig. 22. Cell elements of the circulating fluid of the gastric canal system. 900 : 1. Division goes on after separation from the parent endothelium.

Fig. 23. Phagocyte from tentacular sheath that has ingested portions of colloblasts. *n* nucleus. 900 : 1.

Fig. 24. Ciliated epithelium of ventral surface of body. 300 : 1 (cf. Fig. 7). The gland cells (*gl. c*) are in Stage B of the cycle, *mb* muscle bundle cut transversely, *m. l* layer of muscle cells immediately underlying the epithelium, *ep* and separating it from the loose parenchyma.

Plate 10.

Fig. 25—31. Stages in the development of a colloblast (*C. willeyi*). 900 : 1. Fig. 25, 26, 27 are looked at from above, the rest from the side. Fig. 25, the undifferentiated cell. Fig. 26, the chromatin begins to aggregate into "nucleoli". Fig. 26. These concentrate about the nucleus proper. Fig. 27. The cytoplasm begins to differentiate into a denser inner column and a spiral outer thickening. Fig. 28—29. The nucleoli have blocked off the cytoplasm about the nucleus into the typical mulberry shape, the central column has thinned and the spiral filament has become much more definite. Fig. 30, the typical spiral filament

established by the breaking away of the margin of the cell to form the cup. The nucleoli are disappearing.

Fig. 32. A strand of endothelium of a gastric canal of *C. willeyi*; budding off cells into the circulating stream. 900 : 1. a) cells just divided, b) one just separating from the strand.

Fig. 33. Flagellate epithelium of the floor of the pharynx. 800 : 1. *gl. c* a gland cell in Stage C, — the greater part of the granules have apparently been thrown out — the nucleus is visible and apparently Stage A is beginning in the lower part of the cell. *l* lacunae between cells due to shrinkage in fixation.

Fig. 34. Horizontal section through root of tentacle muscle and accessory sheathes at sides, *C. willeyi*. 80 : 1. *g. can* lumen of branches of gastric canal system (tentacular canal) running into the root of the tentacle from the infundibulum, *en* endothelial lining of canal system, *m. l* formative layer of undifferentiated cells from which both muscle and colloblasts arise (in this region largely muscle cells), *m. c* packing of muscle cells about the sheath, *ten* muscle of the tentacle proper.

Fig. 35. A portion of Fig. 34 (X) more highly magnified. 900 : 1. *en* endothelial lining of canal system, *m. c* muscle cells converging to form a fiber (*mf*) of the tentacle.

Fig. 36. Epithelial cells of the dorsal surface. 360 : 1. *a* gland of doubtful nature possibly similar to the "albumin cell" described by others. The other two are typical gland cells in Stage C. *b* one discharging its contents, *g* granules passing to the exterior.

Fig. 37. Transsection of secondary tentacle of *C. willeyi*. 95 : 1. Most of the colloblasts are torn off. *i. m* inner layer of longitudinal muscles of tentacle (cf. Fig. 4).

Fig. 38. Transsection (thick) of secondary tentacle of *C. mitsukurii*. 300 : 1. *col* colloblasts, *o. c. m* outer layer of circular muscle in which the filaments of the colloblasts are inserted, *i. c. m* inner circular layer, *o. m* outer longitudinal muscle strands, *i. m* inner longitudinal muscle strand.

Fig. 39. Strands of endothelium budding off cells into the canal system. 900 : 1. *s* septum between two adjacent canals, *a* typical cell with central large nucleus surrounded by clear space, *b* suggests the origin of such a cell in the fusion of several smaller ones.

Fig. 40. Flagellate epithelium of stomodaeal canal. *C. willeyi*. 800 : 1.

Onychodactylus japonicus Bonaparte, Icon. Fauna Ital., II, fasc. xxvi, 1839, fol. 131**, 2.—Gray, Cat. Batr. Grad. Brit. Mus., 1850, p. 33, pl. iii, fig. 15 (Japan).—Strauch, Mém. Acad. Sci. St. Pétersbourg (7), XVI, No. 4, 1870, p. 60 (Japan).—Troschel, Arch. Naturg., 1877, I, p. 199, pl. xv (elaborate descriptions of adult and larva).—Hilgendorf, Sitz. Ber. Naturf. Freunde Berlin, 1880, p. 121 (Hatta village, Hakone Mts.; Oyama, SW. from Yokohama).—Boulenger, Cat. Batr. Grad. Brit. Mus., 1882, p. 35 (Oyama, near Tokyo; Hakone).—Rein, Japan, Engl. ed., 1884, p. 188 (Hakone Mts.).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V (1891), p. 239.—Okada, Cat. Vert. Japan, 1891, p. 65 (Iwaki; vicinity of Oyama; Hakone).—Sclater, List. Batr. Indian Mus. (1892), p. 37 (Hakone).—Boettger, Kat. Batr. Mus. Senckenberg. (1892), p. 58 (Yokohama).

1798. *Lacerta thunbergii* Donndorf, Zool. Beytr., III, p. 132 (based on Thunberg, 1787).

1820. *Molge striata* Merrem, Tent. Syst. Amph., p. 185 (Japan; based on Houttuyn and Thunberg).

1838. *Salamandra unguiculata* Schlegel, Fauna Japon., Rept., pp. 123, 139, Saur. et Batr., pl. v, figs. 1–6 [a] (Hondo and Shikoku).—Geerts, Nouv. Arch. Mus. Paris, (2) V, 1883, p. 275 (Prov. Iga; Mountains of Hakone and Hata).

1838. *Onychodactylus schlegeli* Tschudi, Class. Batr., p. 92 (based on Fauna Japonica).—Duméril and Bibron, Erpét. Gén., IX (1854), p. 114; Atlas, pl. xciii, fig. 1.

1841. *Onycopus sieboldii* Duméril and Bibron, Erpét. Gén., VIII, p. 4 (*lapsus*).

Duméril and Bibron[b] assert that Schlegel's identification of Houttuyn's *Salamandra japonica* as the present species is erroneous, but to anyone who examines the original description and figures it must be perfectly plain that Schlegel was correct. There can be absolutely no doubt as to the identity of Houttuyn's species, and the mistake of the authors of the Erpétologie Générale can only be explained by their having confounded figures 2 and 3 on Houttuyn's plate. The latter states that his specimen was collected by Thunberg in Japan. Thunberg himself described and figured the same species under the same name, though apparently without knowing Houttuyn's description, and he expressly gives the Hakone Mountains (Fakonieberget) as the type-locality, consequently it is in all probability also the locality where he obtained the specimen Houttuyn described.

Description.—Adult male; U.S.N.M. No. 34240; Hakone Lake, Sagami, Hondo; July, 1898; A. Owston, collector. Vomero-palatine teeth in a doubly arched series behind the choanæ, the two arches extending forward to a line through the anterior edge of the choanæ; head flat, rounded anteriorly; nostrils nearer the eye than the tip of the snout, much wider apart than the width of the interorbital space, which is greater than the the upper eyelids; eyes greatly protruding; body elongate, the head from tip of snout to gular fold being contained three and one-third times in the distance from gular fold to anterior angle of vent; adpressed limbs do not meet by a distance of two costal folds; fore legs slender, the four fingers short, but well developed, each with a raised, compressed, brownish black claw; fourth finger slightly longer than first, third longest; hind legs strong and stout; toes depressed, widened at base, each with a black claw like the fingers; first finger very short, fourth longest, fifth equaling third; a thick dermal expansion from the outer side of fifth finger along the outer side of the foot and tibia, giving the foot a very wide under surface; no tubercles; tail long, longer than head and body, nearly cylindrical in the basal half, then gradually more and more compressed to the end, which is rounded; 13 costal grooves which are rather indistinct; a flat parotoid gland on the side of the neck, bordered above and behind by a groove which begins behind the eye and joins the strong gular fold behind the parotoid; a shallow groove along the median line of upper neck and anterior half of back; vent arrow-shaped, the lips of the oblique anterior slits forming the arrows' head distinctly swollen. Color (in alcohol): top of head, the whole median portion of upper neck and back, as well as the upper edge of the tail, "wood brown," sprinkled more or less with blackish brown, most densely on the head; sides of neck, body, and tail blackish brown, the upper outline against the pale band of the back irregular, but very distinct, the lower outline gradually merging into the pale color of the under surface; legs above dark brown, like the lower portion of the flanks, and, like these, with irregular roundish spots of pale wood-brown.

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[a] Reproduced in this work on Plates V–VI.

[b] Erpét. Gén., IX, p. 116.

Dimensions.

	mm.
Total length	161
Tip of snout to gular fold	16
Gular fold to anterior angle of vent	53
Anterior angle of vent to tip of tail	92
Width of head	10
Fore leg	18
Hind leg	21
Height of tail a head-length from vent	8
Width of tail a head-length from vent	7

The *adult breeding female* (U.S.N.M. No. 34245; Hakone Lake; July, 1898; Owston, collector) differs from the male chiefly in the shorter tail and the slenderer hind legs, which, moreover, are devoid of the lateral tarso-tibial enlargement. The vent is also of a somewhat different aspect, inasmuch as the lateral oblique folds, which in the male converge at the anterior end, in the female meet at the middle of the median cleft; the lips of the vent anterior to the lateral folds are much swollen; all the toes provided with black nails.

Dimensions.

	mm.
Total length	141
Tip of snout to gular fold	15
Gular fold to anterior border of vent	54
Anterior border of vent to tip of tail	72
Width of head	11
Fore leg	18
Hind leg	23
Height of tail one head-length from vent	7.5

The *nonbreeding female* is apparently distinguished by the absence of nails, and the vent is a simple longitudinal slit.

The *larvæ* are characterized by the presence of strong, hooked, black claws.

Variation.—The variation in structural characters is unimportant and presents no difficulties with regard to the identification of this species, being chiefly confined to slight deviations in the position of the vomero-palatine teeth relative to the choanæ, and to the number of costal folds, which varies between 12 and 14. The coloration is also rather uniform, the chief difference consisting in the varying degree of fineness of the dark sprinkling in the dorsal pale area, where these minute dots often congregate near the median line so as to form an irregular dusky stripe.

Habitat.—In the Fauna Japonica (p. 125) it is stated that this salamander is found in abundance in the mountainous parts of Hondo and Shikoku, particularly in the provinces of Sagami, Shinano, Tamba, Tazima, and Tosa, and Siebold himself (p. XVI) clearly intimates that he did not obtain it in Kiusiu. Nor am I aware of any record of its having been taken in the latter island. Doctor Fritze states that it is absent in Yezo. Doctor Nozawa, however, in a letter to me enumerates it among the species found there, though as yet he has been unable to secure specimens for me.

To the provinces specifically enumerated above Geerts adds Iga, and Okada adds Iwaki. Most of the specimens in the museums are from Hakone, the type-locality of the species and the locality from which it also takes its Japanese name. Another specific locality from which there are specimens in the British and Berlin museums is Oyama in Sagami province.

The species does not occur outside of Japan proper. It is unknown in the Riu Kiu islands.

List of specimens of Onychodactylus japonicus.

U. S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Total length.
					mm.
34218	Male	Hakone Lake, Hondo	July, 1898	A. Owston	162
34219	do	do	do	do	155
34220	Female	do	do	do	159
34221	Male	do	do	do	168
34222	do	do	do	do	167
34223	Female	do	do	do	144
34224	Male	do	do	do	149
34225	Female	do	do	do	141
34226	do	do	do	do	146
34227	do	do	do	do	128
34228	do	do	do	do	144
34229	Male	do	do	do	144
34230	do	do	do	do	158
34231	do	do	do	do	151
34232	Female	do	do	do	137
34233	do	do	do	do	
34234	do	do	do	do	130
34235	Male	do	do	do	151
34236	do	do	do	do	151
34237	do	do	do	do	155
34238	do	do	do	do	149
34239	Female	do	do	do	140
34240	Male [a]	do	do	do	161
34241	do	do	do	do	148
34242	do	do	do	do	141
34243	do	do	do	do	131
34244	Female	do	do	do	147
34245	do [b]	do	do [b]	do	141
34246	do	do	do	do	150
34247	do	do	do	do	141
34248	Male	do	do	do	153
34249	do	do	do	do	144
34250	Female	do	do	do	145
34251	Male	do	do	do	154
34252	Female	do	do	do	141
34253	Male	do	do	do	155
34254	Female	do	do	do	138
34255	Male	do	do	do	152
34256	do	do	do	do	137
34257	do	do	do	do	155
34258 to 34287	Larvæ	do	do	do	

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[a] Description p. 43.

[b] Description p. 44.

Genus GEOMOLGE[a] Boulenger.

1886. *Geomolge* Boulenger, Proc. Zool. Soc. London, p. 416 (type, *G. fischeri*).

Geomolge appears to be very closely allied to *Onychodactylus*, the chief differences being that in the former the vomero-palatine series of teeth is interrupted in the middle and that it lacks the black, horny claws.

GEOMOLGE FISCHERI[b] Boulenger.

Plate V, fig. 5 6.

1886. *Geomolge fischeri* Boulenger, Proc. Zool. Soc. London, 1886, p. 416, pl. XXXIX, fig. 2[c] (type-locality, Khabarovka, Ussuri; types in Brit. Mus. no. 86. 5. 15. 11–12; Doerries, collector); Ann. Mag. Nat. Hist. (6), V, Feb., 1890, p. 144.—Nikolski, Annuaire Mus. Zool. St. Pétersbourg, I, 1896, p. 77 (Valley of Sutchan River, Ussuri district; St. Petersb. Mus., No. 1904; Busse, collector); Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, 1905, p. 440 (Ussuri).

There being no specimen of this species in the U. S. National Museum, an abstract of Boulenger's original description is given:

Physiognomy that of *Onychodactylus japonicus*; . . . . . . limbs in every respect similar to those of *Onychodactylus japonicus* save the absence of claws; the male likewise with tibio-tarsal dilatation; . . . . . . anal opening subcruciform, as in *Onychodactylus*; skin smooth; 14 or 15 costal grooves; parotoids and gular fold as in *Onychodactylus*. Brown above, with blackish variegations, most crowded on the sides, which also bear some whitish spots; lower surface brownish white.

	Male.	Female.
	mm.	*mm.*
From snout to vent	70	80
Head	12	14
Tail	93	.......[d]

Habitat.—This species was collected by Mr. Doerries near Khabarovka, in the Ussuri. Nikolski has since recorded a specimen from the valley of Sutchan River, also in the Ussuri district. Beyond this nothing is known of the distribution of this species.

Order SALIENTIA.

1768. *Salientia* Laurenti, Syn. Rept., p. 24.
1777. *Ecaudata* Scopoli, Introd. Hist. Nat., p. 464.
1788. *Batrachi* Batsch, Anleit. Kenntn. Thiere Mineral., I (p. 437).
1802. *Ranæ* Shaw, Gen. Zool., III, Pt. 1, p. 5.
1806. *Ecaudati* Duméril, Zool. Anal., p. 92.

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[a] From γῆ, the earth, land, and the generic term *Molge* Merrem, a synonym of *Triturus* Rafinesque, derived from the German word Molch, a salamander.

[b] Named in honor of Dr. Johann Gustav Fischer, the well-known Hamburg herpetologist. Born on March 1, 1819; died on January 27, 1889.

[c] Reproduced in this work on Plate V.

[d] Boulenger, Proc. Zool. Soc. London, 1886, p. 416.

1813. *Anuri* FISCHER, Zoognosia, 3 ed., 1, p. 58.
1825. *Anoura* LATREILLE, Fam. Nat. Règne Anim., p. 104.
1828. *Pygomolgæ* RITGEN, Nova Acta Acad. Leop. Carol., XIV, p. 278.
1828. *Acerci* WAGLER, Isis, 1828, p. 859.
1832. *Batrachia* MUELLER, Isis, 1832 (p. 504).
1833. *Miura* VAN DER HOEVEN, Handb. Dierk., II, Pt. 2, p. 307
1835. *Heteromorpha* FITZINGER, Ann. Wien Mus., I, p. 107.
1839. *Raniformia* HOGG, Mag. Nat. Hist. (n. s.), III, p. 271.
1855. *Batrachii* VAN DER HOEVEN, Handb. Dierk., 2 ed., II, p. 468.
1866. *Anura* HAECKEL, Gen. Morphol., II, p. CXXXII
1878. *Acaudata* KNAUER, Naturg. Lurche, p. 100.

The name adopted for this order varies greatly with the various authors. Thus Salientia, Anura, and Ecaudata are used almost indiscriminately. Of these Salientia is the oldest.

It is perfectly true that the various rules for zoological nomenclature do not compel a strict application of the law of priority to groups higher than genera, and that the A. O. U. code specifically proclaims this, but the principle underlying the modern way of fastening a name to a genus is very different from that involved in naming an order or a class. The ends in view are different, and the modus operandi must also be different. Nobody nowadays in applying a generic term cares the least whether the name, as originally proposed, covers the same aggregate of species, even approximately, as the genus to which he attaches it, or not. It is enough that a single species, the type species, is included in the original group and in the one adopted. This, however, is a comparatively modern view. In the early days, when generic terms were few, and long before the term "type-species" or "genotype"(!) was invented, it happened quite frequently that authors selected a new generic name for a group which contained the essential elements of one previously named, simply because his grouping was not coextensive with that of his predecessor's. But as new discoveries and closer studies multiplied the genera, and the views as to their compass became more and more divergent, it was found impossible to adhere to such a principle as far as generic terms were concerned.

Not so with the terms for orders and classes. It has always been the recognized custom to employ a name embracing, at least approximately, an assembly of genera, or orders, coextensive with it when first proposed. The inconvenience caused by the coining of new names of groups higher than genera has been small compared to the convenience of knowing approximately the extent of a group by the name applied to it. A good reason why it is inconvenient and inexpedient to apply strictly the law of priority to such higher groups is the fact that we know no such thing as a "type genus" or a "type order" by the aid of which the name of the order or the class can be arbitrarily fixed, even if it were desirable to do so.

As a general proposition it may be stated that there is but little divergence among authors with regard to the names of classes and orders. Common usage has in most cases been too strong for the extremists, who have either tried to apply names according to priority or who have inflicted new ones every time the "rank" of the group was changed or a trifling component part shifted from one group to another, or whose fine linguistic sensitiveness compelled them to improve the name and render its form "classic." There are names which it has been impossible to dislodge, which are employed almost unanimously. These it would be folly to attempt to disturb.

The principle which has guided me in selecting the names of orders and classes may be stated briefly as follows: In cases where a term has not received a practically universal acceptance the oldest known group name (above a generic name and later than 1758) is applied, which covers approximately the same aggregate of genera, irrespective of the comparative rank assigned to the group by the original namer, provided its form is not the plural of a current genus in the same class, nor that now universally adopted for superfamilies, families, and subfamilies.

The application of this principle may be shown by a few examples. Thus Salientia is adopted as being the oldest known group name for the present order, because when originally proposed it covered the same aggregate of genera as now, and none of the later names of the same compass have received universal acceptance. On the other hand, Gradientia has been rejected, although it is older than Caudata, and the latter adopted, because the term Gradientia, as originally proposed, embraced the saurian reptiles as well. Oppel's Squamata has been accepted for the reptilian order containing the lizards and snakes, although it included the crocodiles, a discrepancy too slight to affect the general applicability of the term. Again, Testudinata, although proposed four years later than Link's Cataphractæ, has been accepted in preference to the latter (after the elimination of the older terms Testudines and Chelonia as conflicting with the earlier or synchronous generic names *Testudo* and *Chelonia*) because of the comparative currency of that term, as against the almost total obscurity of the one coined by Link. Finally, the suborder containing the soft-shelled turtles is called Chilotæ in spite of the fact that the term Trionychoidea is both earlier and commonly adopted, the reason for the rejection of the latter name being that its form is identical with that of the superfamily.

The Salientia may be divided into three suborders, viz, Aglossa, Linguata, and Costata, of which the first one is distinguished by having the eustachian tubes united into a single pharyngeal opening and no tongue, while the last one is amply characterized by the presence of ribs. The Aglossa are only found in Africa and South America; the other two suborders are represented within our area.

Suborder COSTATA.

1879. *Costati* Lataste, Act. Soc. Linn. Bordeaux, XXXIII, 1879, p. 339.

Salientia having a tongue; eustachian tubes, when present, with two pharyngeal openings; ribs present and a pair of transverse processes near the proximal end of the coccyx. Larvæ with one spiraculum in the middle of the thoracic region.

The Costata, which embrace only one family, the Discoglossidæ, have a very wide and disconnected distribution showing their great antiquity and fully bearing out the verdict of Professor Howes, based upon anatomical investigations, that they are "by far the least modified of living anura."[a]

The principal center of distribution at present is central and southern Europe, where three genera together with five species are at home, one of these species extending its range into northwestern Africa and another into central Russia. At the other extreme of the Palearctic region another species of one of the European genera maintains its isolated existence, namely, the species to be treated of in this work, while in the Yunnan region another one has recently been discovered. Two more genera belong to this family, both widely removed from the above, namely, *Liopelma*, the single species of which is the only batrachian occurring in New Zealand to which antipodal island group it is peculiar and where it seems to be very rare, and *Ascaphus*, represented thus far by two specimens only, of a single species, *A. truei*, which has recently been discovered in the State of Washington, not far from the Pacific coast. The extreme rarity of the last two species would seem to indicate that they are nearing extinction.[b]

Family DISCOGLOSSIDÆ.

Only this family is included in the suborder.

Genus BOMBINA[c] Oken.

1816. *Bombina* Oken, Lehrb. Zool., II, p. 207 (type, *Rana bombina*).
1820. *Bombinator* Merrem, Tent. Syst. Amph., p. 178 (same type).
1830. *Bombitator* Wagler, Nat. Syst. Amph., p. 206 (emendation).

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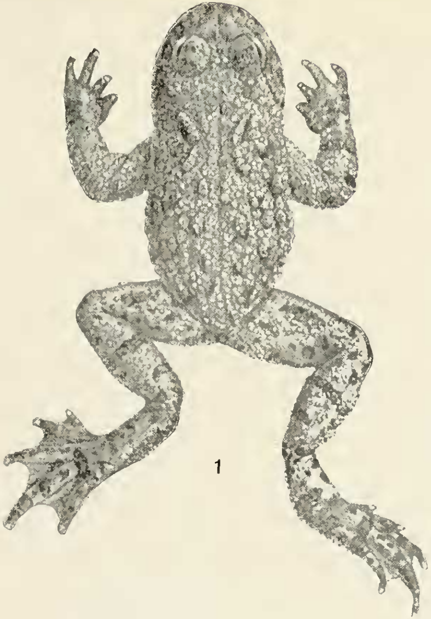
[a] Proc. Zool. Soc. London, 1888, pp. 178, 506.

[b] See Stejneger, A Résumé of the Geographical Distribution of the Discoglossoid Toads in the Light of Ancient Land Connections, in Bull. Amer. Geogr. Soc., XXXVII, No. 2, Feb. 1905, pp. 91-93; and The Geographical Distribution of the Bell-Toads, in Science (n. s.), XXII, Oct. 20, 1905, p. 502.

[c] From the medieval Latin verb *bombinare*, to utter a *bombus*, a loud hollow sound, such as the stroke of a bell.



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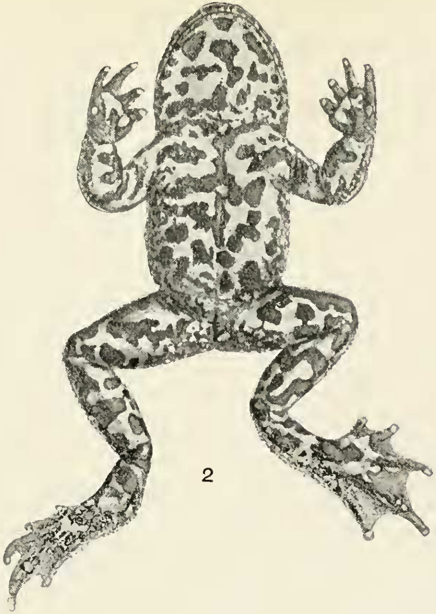

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Bombina orientalis. (From Boulenger.)

For explanation of plate see page 554.

The genus *Bombina* has a very curious distribution. Two species, *Bombina bombina* (Linnæus) and *Bombina salsa* [a] (Schrank), occur in Europe, the former in northern and eastern central Europe. The latter, which seems to embrace several local forms, such as *B. salsa pachypus* (=*Bombinator apenninicus* Gistel and Bronne, 1850), in Italy, *B. salsa nigriventris* (Dueringen) in Bosnia and Montenegro, *B. salsa kolombatovici* (Bedriaga) in Dalmatia, etc., occupies France, parts of southern central Europe, Italy, and the Balkan peninsula. None of these species extends eastward beyond the Volga. A third species of the genus occurs in eastern Asia, though probably not to the west of a line through Lake Baikal. A fourth species, *Bombina maxima*, has recently been described from Yunnan at an altitude of 6,000 feet.

BOMBINA ORIENTALIS [b] (Boulenger).

Plate VII.

1878. *Bombinator igneus* MARTENS, Preuss. Exped. Ost-Asien, Zool., I, p. 384 (not of Laurenti) (Chefu, N. China).—BOULENGER, Cat. Batr. Sal. Brit. Mus., 1882, p. 447 (part: Chefu, China).—BOETTGER, Offenbach. Ver. Naturk. 24–25 Ber., 1885, p. 164 (Chefu).

1890. *Bombinator orientalis* BOULENGER, Ann. Mag. Nat. Hist. (6), V, Feb. 1890, p. 143, pl. IX, fig. 2 [c] (type-localities, N. China, Korea, Khabarovka; types in Brit. Mus.); Proc. Zool. Soc. London, 1890, p. 326 (Chefu; Korea; Ussuri).—WERNER, Abh. Bayer. Akad. Wiss., (Muenchen) II Klasse, XXII, Pt. 2, 1904, p. 359 (Tsingtau, China).—NIKOLSKI, Zap. Imp. Akad. Nauk, S. Peterburg, (8) XVII, No. 1 (1905) p. 415 (Vladivostok; Korea, etc.).

Description (figs. 39–43).—*Adult male;* U.S.N.M. No. 17522; Fusan, Korea; 1885; P. L. Jouy, collector. Vomerine teeth in two small transverse oval groups behind the level of the choanæ; tongue oval, truncate behind, large, adherent all around; snout flat, rounded, without canthus rostralis; nostrils on top of snout about halfway between eye and tip of snout, distance from each other equaling the interorbital space, which is narrower than the upper eyelids; no tympanum; parotoid gland long, narrow, indistinct; no gular sac; a very faintly indicated gular fold; fore leg well developed, longer than half the length of head and body; fingers short, depressed, first shortest, third longest, second and fourth of about equal length; no subarticular tubercles, but a large and distinct inner palmar pad and a smaller indistinct outer one; a large patch of horny nuptial excrescences on the inner side of the fore arm, and smaller patches on the inner side of the large palmar pad, and of first, second, and third toes; when hind leg is carried forward along the side, the heel reaches the corner of the mouth and tarso-metatarsal joint slightly beyond the tip of the snout; tibia equals distance from base of inner metatarsal tubercle to tip of longest toe; heels just meet when the femurs are placed at right angles to the axis of the body; toes short, webbed nearly to their tips, webs deeply excised, third toe longer than fifth; no subarticular tubercles; inner metatarsal tubercle small and weakly developed, no outer tubercle; no nuptial excrescences on toes; upper surface covered with closely set and irregularly arranged prominent tubercles of varying size, all sprinkled over with minute, dark brownish points and each surmounted by one or more horny spines, the base of which is pale and the tip blackish brown; underside smooth, with the posterior part of the belly and proximal parts of femurs somewhat rugose; outer side of sole of feet and underside of base of fifth toe with spines like the upper side. Color (in alcohol) above dark drab-

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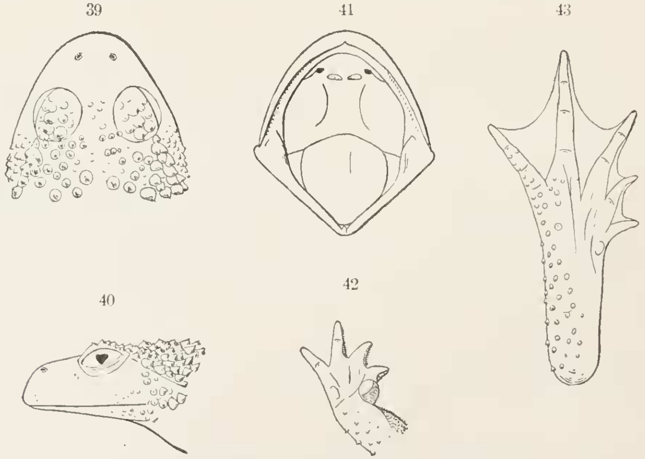
[a] In his Tailless Batrachians of Europe, p. 322, footnote, Doctor Boulenger, in adopting the sixteen years younger name *Rana agilis* in preference to the older *R. dalmatina*, as required by "the strict application of the law of priority," pleads that "this is one of those cases in which, it appears to me, conservatism is desirable," and he continues: "Similar considerations have guided me in the naming of the two species of the genus *Bombinator*, and I hope, in the interest of stability of nomenclature they will commend themselves to future workers." It is indeed not uncommon to hear the breaking of this law termed "conservatism," and certainly the conservatives ought to know if that is a correct definition, but we radicals prefer to submit to the law as the only means of obtaining the desired "stability of nomenclature." If Boulenger, in the two cases cited, had followed the law we would by this time have reached stability in their cases, while now it has been postponed probably for a generation. Who is to decide in which cases it is allowable to break the law and substitute "conservatism?" A simple "it appears to me" applied here and there by a dozen herpetologists would cause a fine "stability!"

[b] Eastern.

[c] Reproduced in this work on Plate VII.



FIGS. 39-43.—BOMBINA ORIENTALIS. 1½ × NAT. SIZE. 39, TOP OF HEAD; 40, SIDE OF HEAD; 41, OPEN MOUTH; 42, UNDERSIDE OF RIGHT HAND SHOWING NUPTIAL EXCRESCENCES; 43, FOOT. No. 17522, U.S.N.M.

gray, with irregular obscure dusky spots and dusky cross-markings on the limbs; a pale sage-green spot of irregular outlines across the back between the fore legs and two smaller ones, still more indefinite on each side of the back about the middle; a pale longitudinal stripe on the tip of the snout from the level of the nostrils to the lip; lips dusky; underside pale buff (red in life), with numerous blackish, sharply defined, irregular spots; palms buff (red), separated from the similarly colored under surface of the fore arm by a black wristband; a large buff (red) spot on the inner side of the plantar surface, involving the entire first toe, below and above, and continuous with the similarly colored patch on the inner side of the tarsus; tips of all the digits abruptly and bright buff (red) above and below.

Dimensions.

	mm.
Tip of snout to vent	44
Tip of snout to gular fold	16
Width of head	16
Width of interorbital space	3
Fore leg	25
Hind leg, from vent	62
Foot from base of inner metatarsal tubercle to tip of longest toe	18

Sexual variation.—The males of this species during the breeding season possess groups of blackish horny excrescences on the inner side of fore arm, palmar tubercle and first, second, and third fingers exactly as in *Bombina salsa;* but, unlike the latter, there are none on the posterior extremities. In the female the fingers are longer and slenderer, especially the outer one. The dorsal spines and asperities are smaller.

Color variation.—In the series before me there is very little deviation from the coloration of the underside as described above. In two specimens, Nos. 17527 and 17530, the blackish markings are larger, especially in the latter, in which the underside may be described as black with buff (red) spots; in both, the plantar light patch is separated from the tarsal patch by a narrow black bridge, in No. 17530 only on one foot, however. The upper surface is considerably more olive in some specimens and the dusky spots and markings above much better defined and darker.

Habitat.—The eastern bell-toad is confined to northeastern China, Korea, and the Ussuri country. Specimens from all of these localities are in the British Museum. The U. S. National Museum possesses nine specimens collected in 1885 by P. L. Jouy near Fusan, Korea. Pleske's specimens from Vladivostok are in the Academy Museum in St. Petersburg, and the Hamburg Museum also has it from the same locality (No. 862), collected by Dieckmann in 1894. In the St. Petersburg Museum there are also specimens collected by Poljakow at the Novgorodski Port, Possiet Bay.

List of specimens of Bombina orientalis.

U. S. N. M. No.	Sex.	Locality.	When collected.	By whom collected.
17522	Male [a]	Fusan, Korea	1885	P. L. Jouy.
17523	do	do	1885	Do.
17524	do	do	1885	Do.
17525	do	do	1885	Do.
17526	do	do	1885	Do.
17527	do [b]	do	1885	Do.
17528	do	do	1885	Do.
17529	Female	do	1885	Do.
17530	Male [b]	do	1885	Do.

[a] Description, p. 51; figs. 39-43.

[b] P. 53.

Suborder LINGUATA.

1845. *Linguata* Gravenhorst, Thierreich, p. 43.
1847. *Phaneroglossa* Gervais, Dict. d'Hist. Nat., IX, p. 721.

Salientia having a tongue; eustachian tubes with two pharyngeal openings; lacking ribs and transverse process to urostyle. Larvæ with one spiraculum on left side only.

The term *Ranæ phaneroglossæ* used in 1830 by Wagler (and usually quoted simply as "Phaneroglossa") included the majority of both Salientia and Caudata. Duméril and Bibron first restricted the "Phanéroglosses" (first latinized by Gervais in 1847, so far as I have been able to ascertain) to the Salientia with a tongue, therein including also the Discoglossidæ. Those who still regard these as belonging to the same suborder as the other tongued Salientia will probably retain the name Phaneroglossa. Gravenhorst's *Linguata* may then be restricted to the latter without the genera having ribs. Originally, it is true, it was meant to be equivalent to the Phanéroglosses, but it has never been accepted for them, and the Discoglossidæ form so small a portion that it is better to retain it as here defined than to create a new name.

The families to which the toads and frogs inhabiting our region belong may be distinguished as follows:

KEY TO FAMILIES.

*a*¹ Clavicle and coracoid of each side connected by a longitudinal arched cartilage, which overlaps that of the opposite side.
  *b*¹ Both jaws toothless .... Bufonidæ
  *b*² Upper jaw toothed .... Hylidæ
*a*² Clavicles and coracoids of both sides firmly united by a single median cartilage.
  *b*¹ Both jaws toothless; sacral diapophyses dilated .... Engystomidæ
  *b*² Upper jaw toothed; sacral diapophyses not or but slightly dilated .... Ranidæ

The characters of the two groups indicated by a^1 and a^2 correspond to those of Cope's Arcifera and Firmisternia, respectively, divisions which Boulenger calls "series."

As the employment of the systematic arrangement given above for purposes of identification would necessitate dissection of the specimens, I add the following artificial Key, by which the Salientia occurring within our limits may be referred to their respective families by external characters alone:

KEY TO THE JAPANESE FAMILIES OF TAILLESS BATRACHIANS.

a^1 Digits without subarticular tubercles; pupil triangular (Suborder COSTATA)...... DISCOGLOSSIDÆ, p. 50
a^2 Digits with subarticular tubercles; pupil round or horizontal (Suborder LINGUATA).
  b^1 A parotoid gland.................................BUFONIDÆ, p. 55
  b^2 No parotoid gland.
    c^1 Tongue without posterior prolongations or "horns."
      d^1 Upper jaw toothed.................................HYLIDÆ, p. 75
      d^2 Upper jaw toothless.............................ENGYSTOMIDÆ, p. 87
    c^2 Tongue with two posterior horn-shaped prolongations..........RANIDÆ, p. 92

Family BUFONIDÆ.

A large family having no maxillary teeth, a large parotoid gland behind the head, shoulder-girdle arciferous, and lateral sacral processes dilated. Distributed over the entire globe, except the polar regions, New Zealand, and Polynesia. Some forms are aquatic, some arboreal, some burrowing in their habits, but most are terrestrial. They feed largely on insects, and are among the best friends of the farmer and gardener, by whom they ought to be protected instead of persecuted and exterminated, as they usually are, on account of their often unattractive appearance.

Only one genus is represented within the territory covered by this work.

Genus BUFO[a] Laurenti.

1768. *Bufo* LAURENTI, Syn. Rept., p. 25 (type, *B. vulgaris*).
1788. *Buffo* LACÉPÈDE, Hist. Nat. Quadr. Ovip., I, Syn. Meth. (emendation).
1814. *Batrachus* RAFINESQUE, Specchio Sci., (Palermo), II, fasc. 7 (substitute for *Bufo*).
1815. *Bufotes* RAFINESQUE, Analyse Nat., p. 78 (substitute for *Bufo*).
1816. *Calamita* OKEN, Lehrb. Zool., II, p. 209 (type, *B. calamita;* not of Schneider 1799).
1828. *Chascax* RITGEN, Nova Acta Acad. Carol. Leop., XIV, p. 278 (type, *Bombinator strumosus*).
1843. *Phryne* FITZINGER, Syst. Rept., p. 32 (type, *B. vulgaris*).
1843. *Phrynoidis* FITZINGER, Syst. Rept., p. 32 (type, *B. asper*).
1864. *Epidalea* COPE, Proc. Phila. Acad., 1864, p. 181 (type, *B. calamita*).

The above synonyms are based upon species occurring within our limits or are additional to those found in previously published synonymies. The other synonyms of *Bufo* are too numerous to be reproduced here.

The status of the Japanese toads is still very unsatisfactory.

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[a] The Latin word for toad.

It will be remembered that Schlegel, in Fauna Japanica, described the toad of Japan as a variety of the European toad, to which he attached the name *Bufo vulgaris japonicus,* suppressing Boie's name *B. prætextatus*, as he says, "because of the great affinity which this toad has to that of Europe, of which it is the representative in Japan." The differences indicated by him are chiefly those of coloration.

Camerano, in 1879, found the differences to be of such a character as to induce him to regard the Japanese toad as a species, *Bufo japonicus*, his principle being that any well-defined local form should be so considered. His material consisted of 18 specimens in the Zoological Museum at Turin, nearly all being from Tokyo and Yokohama.

In the following year, 1880, we find both Lataste and Boulenger treating of the subject. The former, who examined fourteen specimens from Peking and two specimens from Japan (lent him by Camerano), expresses himself in favor of recognizing a *Bufo vulgaris japonicus*, while the latter, with sixteen specimens from various Chinese localities and five Japanese, pronounced in favor of an undivided *Bufo vulgaris.* The chief characters, he stated, are the more prominent and spinous warts and the black horny layer on various parts of the body, the rather larger head, and the blackish stripe on the flanks. None of these characters appears to him to be constant, and he adds that if the Japanese form should be separated from the European it should certainly also be separated from the Chinese: "But I do not think that distinction necessary." This conclusion he adhered to in his Catalogue of Batrachia Salientia, issued two years later. It should be noted, however, that in the description of the species he was obliged repeatedly to make exceptions for Chinese or Japanese specimens.

Additional material did not alter his view, for, in 1890, in a paper on the reptiles and batrachians of Amurland, he treats of *Bufo vulgaris* in the following language:

> Its eastern range extends over nearly the whole of China and Amoorland and Japan. The differences between European and Japanese specimens, which consist chiefly in the greater size and perfect distinctness of the tympanum, the black lateral stripe, and the deep black spots or marblings of the lower parts in the latter, are completely bridged over by the Chinese and Manchurian specimens. Specimens from Ichang, on the Yangtse Kiang, and Ningpo come nearest the Japanese, from which they do not differ in coloration; but the tympanum, although as distinct, is not so large. Specimens from Shanghai, Chefoo, Peking, and Korea are intermediate between the latter and the European; the tympanum is always very distinct, but varies considerably in size; the dark lateral stripe is usually ill-defined or absent, and the belly may be either largely spotted with black or almost immaculate. Judging from the two specimens collected at Chabarowka by Hr. Dörries, the northernmost form is still nearer the European; the tympanum is rather small, but perfectly distinct, the belly is immaculate, and the coloration might be said to be identical with that of European specimens, but for the presence of traces of a light vertebral line, as is often found in specimens from Japan, Korea, and Northern China.

This statement is almost literally repeated in his latest work on the Tailless Batrachians of Europe (1898).

In the meantime (1883) he had described and figured a *Bufo formosus* from two specimens collected by the *Challenger* Expedition at Yokohama, which "in its general characters agrees with *Bufo vulgaris*, especially the Japanese form." The main distinctions relied on are the large size of the tympanum, the greater length of the hind leg, the more elongate digits, more excised webs of the hind foot, and the shortness of the first finger.

Nothing more is heard of this species. In the subsequent discussions of the "Japanese form" of *Bufo vulgaris* there is not the slightest reference to it. The fact, however, that the name is not included in Boulenger's synonymy of *Bufo vulgaris* in his Tailless Batrachians of Europe, nor the types in the list of specimens appended, seems to indicate that he still maintains its distinctness, although some doubt arose in my mind upon seeing that in the appendix to the latter work he enumerates a specimen from Dagoshima,[a] collected by Doctor Anderson in May, 1884, under *Bufo vulgaris*. To me this specimen, which the authorities of the British Museum kindly allowed me to examine in 1898, is a strongly marked *Bufo formosus* with the types of which I compared it.

Much of the uncertainty is probably due to the confusion of these two toads in Japan. Thus, on examining the large series in the Leiden Museum upon which Schlegel founded his *Bufo vulgaris japonicus*, I discovered that he had both forms before him. I think it is also certain that Camerano based his conclusion of the specific distinctness of *Bufo japonicus*, or *B. prætextatus*, as he called it in his elaborate paper of 1901, upon true *Bufo formosus*.

The status of the Japanese toad resolves itself into three queries:

(1) Is there more than one species of *Bufo* in Japan?

(2) Is one of these identical with the species on the mainland?

(3) In case of different forms being recognized, what names are to be employed?

First, then, are there more than one species of *Bufo* in Japan proper? In the material which I have had an opportunity to examine, viz, 13 specimens in the Leiden Museum, 9 specimens in the British Museum, and 36 in our own National Museum, there appear to be three forms. One has larger tympanum, longer limbs, slenderer digits, much more deeply excised webs, longer and narrower parotoids, and, as a rule, the first finger shorter than the second. This is the so-called *B. formosus*. That we have not to do with sexual or seasonal differences seems plain. Thus the males with the nuptial asperities on their fingers, which under this assumption would have the greatest extent of web, on the contrary show a minimum size of the interdigital membranes.

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[a] Probably Dogashima, near Miyanoshta.

A very similar form, possibly confined to Shikoku, having the deeply excised webs, long parotoids, long limbs, and slender digits, is very near to *B. formosus*, but has a much smaller tympanum and first and second fingers subequal.

The third form is characterized by small tympanum, stouter and shorter limbs, much larger webs, the true *B. japonicus*.

In spite of the general similarity in coloration and otherwise it is difficult to escape the conclusion that the Japanese toads represent three more or less distinct forms, and as it is at present impossible to establish their interrelationship clearly it is thought best to designate them by binominal appellations. The great difficulty arises in ascribing definite geographical limits to them. Unfortunately, a large number of the specimens examined are without indication of their exact origin. Thus all the specimens in the Leiden Museum collected by Buerger and von Siebold are only labeled "Japon." Several in the British Museum are similarly deficient. The only true *B. japonicus* with a definite locality attached seems to be one from Kobe in the British Museum and one from Miyakoshima in Science College Museum. On the other hand, it would almost appear as if all the *B. formosus* of which the exact locality are known came from near Tokyo and Yokohama (Camerano's specimens; types in British Museum; specimens in United States National Museum) and Dagoshima, wherever that locality may be.[a] We have thus an indication of the *B. formosus* being eastern and northern, while the one with the larger webs, etc., may be more western.

Finally, the only authentic locality from which I have seen specimens of the new form, further on described as *B. smithi*, is the island of Shikoku. There is a specimen in the Imperial Museum in Ueno Park, Tokyo, apparently belonging to this form, which was in a bottle with the type specimen of *Polypedates ishikawæ* and said to have come from Okinawa shima, Riu Kiu. As no toad has been recorded by any collector from that archipelago, the locality given becomes very doubtful.

The next question then is whether any one of the forms which we thus recognize as occurring in Japan is identical with the toads occurring on the mainland. I have already quoted Boulenger to the effect that there are several forms, though he does not recognize them by name because they intergrade. Let it be understood at once that the form in Japan most remote from the mainland forms is *B. formosus*. It is consequently the so-called *B. vulgaris japonicus*, i. e., the one with the greater webs, shorter parotoids, shorter legs, etc., which comes nearest to the mainland forms. Boulenger then maintains that this form approaches the Chinese specimens from Ningpo and Yangtse-Kiang, while the Shanghai, Chefu, Manchurian, Korean, and Ussuri specimens are intermediate between the Japanese form and the true European *Bufo vulgaris*. The differences are chiefly those of color, and the relative size and distinctness of the tympanum. Thus Boulenger, in discussing the characters of *Bufo formosus* asserts that a black line bordering the lower lip "is constant in the Japanese specimens of *B. vulgaris*, absent in the continental specimens." On the whole, my own observations corroborate those of Boulenger; yet while it is admitted that the separating characters are somewhat vague and uncertain, it is considered best to recognize the various local forms for the present at least until more abundant and more reliably labeled material shall have been accumulated. It may then be expedient to recognize three oriental forms of the common European toad, one from eastern South China, one from northeastern China, Korea and Amurland, and one from Japan. The status of a fourth one, *B. sachalinensis*, is more uncertain yet.

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[a] If Dogashima is meant, as surmised by me, the locality agrees well with the others.

The third and final question now arises as to the names to be applied to these forms. As for the Japanese form, the question is somewhat intricate because of the occurrence of several forms or species in the islands. Unfortunately there is nothing in Boie's description of *Bufo prætextatus* by which it can be decided which of these he had before him, and as the type is not in existence, his name may be left out as unidentifiable. Schlegel's material upon which he based his *Bufo vulgaris japonicus*, as has been shown, was composed of specimens of both forms. The illustrations in Fauna Japonica, although very good, fail to throw much light on the question, for while the full figure apparently represents the short-webbed form (*B. formosus*), the profile of the head seems to be taken from a specimen with a smaller tympanum, possibly from a *B. smithi*. The illustrations as well as the description and the type-material consequently are composite. It would then seem that Boulenger's action in describing the short-webbed form as *Bufo formosus* and relegating *B. vulgaris japonicus* to *B. vulgaris* should not now be undone, and that the names must stand as he restricted them.

The South China form must stand as *Bufo bufo gargarizans* (Cantor)[a] while the North China form probably is properly named *Bufo bufo asiaticus* (Steindachner), as Boulenger refers the Shanghai specimens to the same category as the Chefu and Manchurian ones.

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[a] 1842. *Bufo gargarizans* CANTOR, Ann. Nat. Hist., IX, Aug. 1842, p. 483 (type-locality, Chusan, China; types in Brit. Mus.).

1860. ? *Bufo griseus* HALLOWELL, Proc. Phila. Acad., 1860, p. 506 (type-locality, marshes of Whampoa, Hongkong; Stimpson, collector).

The Japanese and North China forms and species may be distinguished as follows:[a]

KEY TO THE SPECIES OF BUFO IN JAPAN, FORMOSA, KOREA, AND SIBERIAN COAST PROVINCE.

- a^1 Top of head without bony ridges.
  - b^1 Inner edge of tarsus rounded, tubercular, with no sharp cutaneous fold.
    - c^1 Web between toes extending only as far as first basal phalanx of third toe and one-half the first basal phalanx of fourth (fig. 48).
      - d^1 Diameter of tympanum about twice as large as its distance from the eye...... *Bufo formosus*, p. 60
      - d^2 Diameter of tympanum about equals the distance from the eye............ *Bufo smithi*, p. 64
    - c^2 Web between toes extends as far as end of the two basal phalanges of third toe and first basal phalanx of fourth.
      - d^1 Underside uniform pale, or with small black spots........................ *Bufo bufo asiaticus*, p. 66
      - d^2 Underside marked with large black blotches.....*Bufo bufo japonicus*, p. 69
  - b^2 Inner edge of tarsus with a sharp cutaneous fold...............*Bufo raddei*, p. 70
- a^2 Top of head with bony ridges..........................*Bufo melanostictus*, p. 72

BUFO FORMOSUS[b] Boulenger.

Plate VIII.

1838. *Bufo vulgaris japonicus* SCHLEGEL, Fauna Jap., Rept., pp. 106, 139 (Japan; specimens in Leiden Mus.; part only); Sauri et Batr., pl. II, fig. 6.

1876. *Bufo vulgaris* var. *prætextatus* MARTENS, Preuss. Exped. Ost-Asien, I, p. 384 (Yokohama) (not of Boie?).—HILGENDORF, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 120.

1879. *Bufo japonicus* CAMERANO, Atti Accad. Torino, XIV, Pt. 5, Apr., 1879, p. 884 (Yokohama; Tokyo; Mus. Zool. Turin; Aimonin and Fontanesi, collectors).

1883. *Bufo formosus* BOULENGER, Proc. Zool. Soc. London, 1883, p. 140, pl. XXIII.[c] (type-locality, Yokohama; types in British Museum; *Challenger* Exped. collect.)—OKADA, Cat. Vert. Jap., 1891, p. 66.—BOETTGER, Kat. Batr. Mus. Senckenberg., 1892, p. 37 (Nikko; Nippon; Japan).

1900. *Bufo prætextatus* CAMERANO, Mem. Accad. Torino, (2) L, p. 113; author's separate, p. 33, pls. I-II (not of Boie?).

Bufo formosus is most easily distinguished from *B. japonicus* by its longer fore limbs, longer and slenderer digits, and much shorter webs between the toes. The alleged difference in the relative size of first and second finger, does not hold in every instance, for I have two specimens of undoubtedly the same species, from Gensan, Korea, in which the relation is reversed, but as a rule it may be said that in *B. formosus* the first finger is shorter than the second, while in *B. japonicus* it is equal to or longer than the second. In *B. formosus*, moreover, the interorbital space appears to be proportionally narrower.

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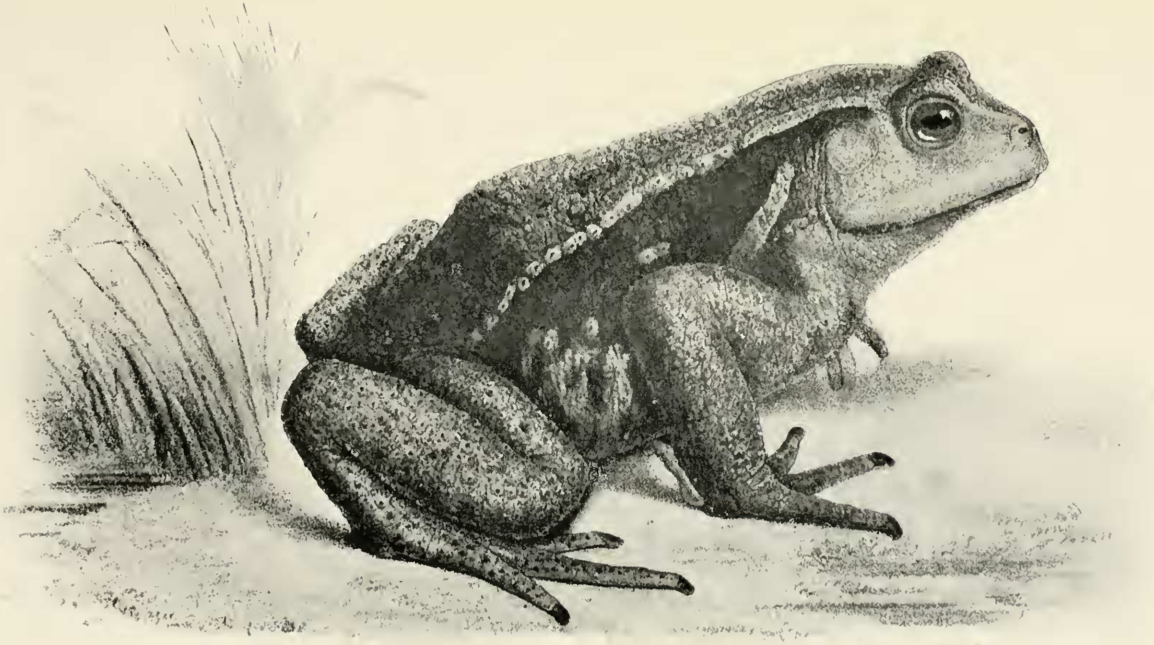
[a] *Bufo sachalinensis* is not given a place in this key, as the characters utilized in the latter are not indicated in the only description of this form thus far published.

[b] Signifying Handsome.

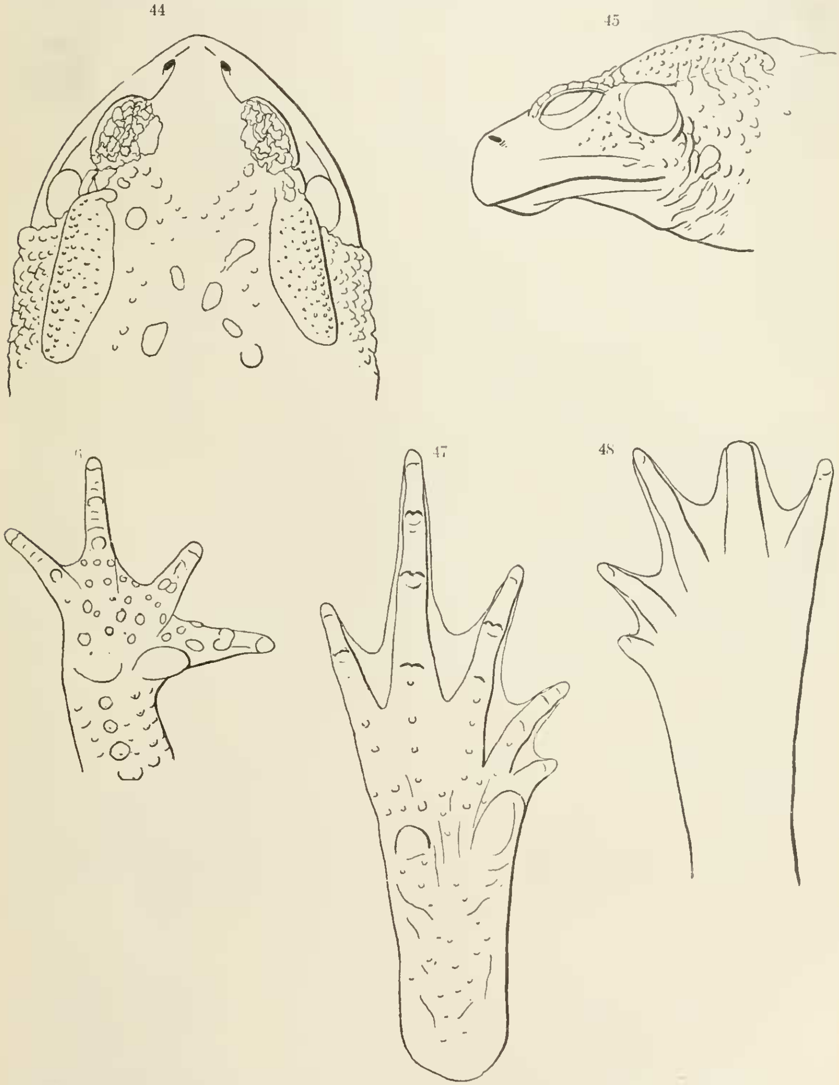
[c] Reproduced in this work on Plate VIII.



Bufo formosus. (From Boulenger.)

For explanation of plate see page 554.

Description (figs. 44–48).—*Adult male:* U.S.N.M. No. 23540; Yokohama; September, 1896; L. Stejneger, collector. Snout somewhat pointed, rising steeply from the labial edge, the canthus rostralis fairly well marked and the loreal region slightly concave; nostrils about halfway between eyes and tip of snout, their distance from each other greater than their distance from the eyes, but less than their distance from the labial edge or than the upper eyelids, and only two-thirds the width of the interorbital space; interorbital space very slightly concave, considerably wider than the upper eyelid; tym-



FIGS. 44–48.—BUFO FORMOSUS. NAT. SIZE. 44, TOP OF HEAD; 45, SIDE OF HEAD; 46, UNDERSIDE OF HAND; 47, UNDERSIDE OF FOOT; 48, UPPER SIDE OF FOOT, TO SHOW EXTENT OF WEB. NO. 23540, U.S.N.M.

panum very distinct, circular, nearly as large as the diameter of the eye, its distance from the latter less than half its own diameter, its distance from the labial edge slightly less than the diameter; parotoid glands rather long and narrow, more than two and a half times as long as wide; fore legs long and stout; fingers with slight webs at the base, tips rounded, third longest, second shortest, and considerably shorter than first; two large palmar tubercles, the inner one particularly prominent with a cutting edge, resembling the inner metatarsal tubercle; nuptial asperities on the inner side of this tubercle, on the inner and upper sides of first and second fingers and on the inner side of the third finger; heels not meeting when folded hind legs are placed perpendicular to the axis of the body; toes one-third webbed, the web extending only as far as the first basal joint of the third toe and one-half the first basal joint of the fourth toe; inner metatarsal tubercle large, with prominent cutting edge, longer than the first toe; outer metatarsal tubercle smaller, rounded, prominent, but less so than the inner one; no tarsal fold; some of the subarticular tubercles double both under fingers and toes; back covered by numerous round tubercles of various sizes, none as large as the tympanum, all rather smooth and not arranged symmetrically, though the larger ones are more numerous toward the sides of the back; under side divided up into small areas by innumerable transverse furrows, each area having one or more small granules or tubercles with a small brown horny tip, these tips becoming larger and almost spiny on the hind legs. Color (in alcohol) on upper side of body nearly uniform sepia; from the posterior corner of the eye backward, margining the lower edge of the parotoid and along the sides of the body to the groin a wide, sharply contrasted, black band; above the latter on the side a smoke-gray border fading into the sepia of the back; a narrow black streak on the lower jaw along its whole length; underside of body and limbs dirty whitish with large strongly defined vermiculations and anastomizing black spots, contiguous with similar though less sharply defined spots on the upper surface of hands and feet; palmar and metatarsal tubercles as well as tips of fingers and toes raw umber.

Dimensions.

	mm.
Tip of snout to vent	110
Tip of snout to anterior border of tympanum	24
Nostril to tympanum	18
Internaral width	6
Interorbital width	10
Diameter of tympanum	8
Distance of tympanum from eye	3
Width of head	46
Fore leg	66
Hind leg from vent to tip of longest toe	147

	mm.
Tibia	42
Hind foot from base of inner metatarsal tubercle to tip of longest toe	52
Length of parotoid	21
Width of parotoid	8

Variation.—The variation of this and allied species has been mentioned above under the general discussion of their status. It may be repeated here that the relative length of the first and second fingers is not constant. Thus, in the type, "the first finger being laid against the second does not extend quite so far as the latter." The same relation holds in over No. 11348, but in my two topotypes these proportions are reversed. The second of these has the whole underside almost uniform whitish with a few scattered dusky spots.

The females differ from the males in this and allied forms in the less-developed fore legs and somewhat larger webs between the toes. They also lack the nuptial pads of asperities on the fingers described above which characterize the males not only during the breeding season but for a long time after, as shown by my specimens which were taken in September.

Habitat.—As indicated above, the only positive locality whence we have undoubted specimens of this species is the neighborhood of Tokyo and Yokohama, to which must be reckoned "Mount Fuji." The locality "Dagoshima" attached to a specimen in British Museum which was collected by Doctor Anderson on May 24, 1884, I have failed to find on any map.[a] A great amount of careful collecting and critical identification will be necessary before the range of this and allied forms in Japan can be determined.

List of specimens of Bufo formosus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Diameter of tympanum.	Distance of tympanum from eye.
						mm.	mm.
U.S.N.M	11348	Adult	Japan		E. S. Morse	5	2.5
Do	23540	Male[a]	Yokohama	Sept. 1896	L. Stejneger	8	3
Do	23541	do	do	do	do	8	3.5
Do	34309	do	Mount Fuji	Aug. 1898	A. Owston	9	4
Do	34310	Female	do	do	do	8.5	3
Do	34311	do	do	do	do	9	3.5
Do	34312	do	do	do	do	9	4
Do	34313	Male	do	do	do	8.5	3
Do	34314	Female	do	do	do	9.5	3.5
Do	34315	Male	do	do	do	8.5	3
Do	34316	Female	do	do	do	8.5	4
Do	34317	do	do	do	do	9	3.5

[a] Topotype; description, p. 61, figs. 44-48.

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[a] Unless it be meant for Dogashima, near Miyanoshta, in Hakone, about 1,300 feet above the sea, consequently not far from the other localities from which we have specimens.

List of specimens of Bufo formosus—Continued.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Diameter of tympanum.	Distance of tympanum from eye.
						mm.	*mm.*
U.S.N.M.	34318	Male	Mount Fuji	Aug., 1898	A. Owston	6.5	4
Do	34319	do	do	do	do	8.5	3
Do	34320	do	do	do	do	9.5	3.5
Do	34321	Female	do	do	do	8	4
Do	34322	Male	do	do	do	8	3
Do	34323	do	do	do	do	10	3
Do	34324	Female	do	do	do	7.5	2.5
Do	34325	do	do	do	do	9	3.5
Do	34326	Male	do	do	do	9	3
Do	34327	Female	do	do	do	8	3.5
Do	34328	do	do	do	do	6	3
Brit. Mus	82.7.14.27	Male [a]	Yokohama		Challenger Exped.		
Do	82.7.14.28	Female [a]	do		do		
Do	86.6.30.31	Male	Dagoshima (?)	May 24, 1884	J. Anderson		

[a] Types.

BUFO SMITHI,[a] new species.

Diagnosis.—Like *Bufo formosus*, but with much smaller tympanum, its diameter about equaling its distance from the eye.

Habitat.—Shikoku Island, Japan.

Type.—U.S.N.M. No. 31951; Kochi, Province of Toza, Shikoku Island; May 11, 1903; Dr. Hugh M. Smith, collector.

Remarks.—This form is so closely allied to *Bufo formosus* that no further description is necessary, the only difference which I have been able to detect being the smaller tympanum which is situated farther away from the eye than in that species. For the sake of completeness a set of measurements of the type is added.

Dimensions.

Male adult; No. 31951 U.S.N.M.; Kochi, Toza, Shikoku; May 11, 1903; H. M. Smith, collector.

	mm.
Tip of snout to vent	110
Tip of snout to anterior border of tympanum	28
Nostril to tympanum	21
Internaral width	7
Interorbital width	9.5
Diameter of tympanum	6
Distance of tympanum from eye	6
Width of head	43
Fore leg	74

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[a] Named after Dr. Hugh M. Smith, United States Deputy Fish Commissioner, who collected the type.

	mm.
Hind leg from vent to tip of longest toe	154
Tibia	44
Hind foot from base of inner metatarsal tubercle to tip of longest toe	54
Length of parotoid	25
Width of parotoid	8

Habitat.—The only definite locality whence we have specimens of this form is Kochi, in the island of Shikoku, where Dr. Hugh M. Smith collected a fine series of specimens in the spring of 1903.

List of specimens of Bufo smithi.

U. S. N. M. Nos.	Sex.	Locality.	When collected.	By whom collected.	Diameter of tympanum.	Distance of tympanum from eye.
					mm.	*mm.*
31851	Male	Suzaki, Toza, Shikoku	May 8, 1903	Dr. H. M. Smith	3.5	3.5
31929	Young	Kochi, Toza, Shikoku	May 11, 1903	do	2	2
31942	Female	do	May 7, 1903	do	5.5	5.5
31943	do	do	May 11, 1903	do	5	4
31944	Male	do	do	do	5.5	5.5
31945	Young	do	do	do	3.5	3.5
31946	do	do	do	do	2.5	2.5
31947	do	do	do	do	2.5	2.5
31948	do	do	do	do	2	2
31949	do	do	do	do	2	2
31950	Female	do	do	do	6	6
31951	Male[a]	do	do	do	6	6

[a] Type.

BUFO SACHALINENSIS[a] (Nikolski).

1905. *Bufo vulg[a]ris* var. *sachalinensis* Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1, p. 389 (type-locality, Sakhalin; types, St. Petersburg Mus., Nos. 1934–1936; Doctor Suprunenko, collector).

Not having seen any specimens referable to this form, I append a translation of Nikolski's original diagnosis:

> Longitudinal diameter of eye contained one and one-half times in length of snout; width of upper eyelid one and three-fourths to two times in interorbital space; forehead smooth (not warty); tympanum very distinct, its diameter equaling two-thirds to three-fourths the longitudinal diameter of the eye; internal metatarsal tubercle very large, its length equaling or exceeding the longitudinal diameter of the eye; a black line always marking the outer margin of the parotoids, as in *B. japonica* Schlegel.

This diagnosis, based upon six specimens, is too brief and does not allude to the crucial characters of the webbing of the toes and to the distance of the tympanum from the eye. Comparing it, however, with specimens of the next species from Korea and with *B. formosus* it almost looks as if the Sakhalin toad may belong to the latter rather than to the former. This, from a zoogeographical standpoint, is rather unexpected, and a comparison of specimens from central Hondo, Yezo, and Sakhalin should be highly instructive.

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[a] From the island of Sakhalin, or Krafto, in the Okhotsk Sea.

Habitat.—Described from, and thus far recorded only from, the island of Sakhalin, where it was collected by Doctor Suprunenko in 1890.

BUFO BUFO[a] ASIATICUS[b] (Steindachner).

1869. *Bufo vulgaris* var. *asiatica* Steindachner, Novara Exped., Zool., I, Amph., p. 39 (Shanghai; Vienna Mus.; Zelebor and Frauenfeld, collectors).

1880. *Bufo vulgaris japonicus* Lataste, Bull. Soc. Zool. France, V, 1880, p. 506 (Peking, China; de Plancy, collector) (not of Schlegel).

1880. *Bufo vulgaris* Boulenger, Proc. Zool. Soc. London, 1880, p. 569 (part, Peking); Ann. Mag. Nat. Hist. (6), V, Feb., 1890, p. 141 (Khabarovka, Ussuri; Korea); Taill. Batr. Europe, Pt. 2, 1898, pp. 213, 347 (part: Khabarovka; Seoul, Chemulpo, Gensan, Korea; Chefoo, Shanghai, China).—Boettger, Ber. Senckenberg. Naturf. Ges., 1894, p. 145 (Shanghai).—Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 358 (Tsingtau, Shanghai).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1, 1905, p. 387 (part: Amur. Ussuri, etc.).

1892. *Bufo vulgaris* var. *japonica* Boettger, Kat. Batr. Mus. Senckenberg., p. 37 (part: Shanghai).

1899. *Bufo japonicus* Stone, Proc. Phila. Acad., 1899, p. 183 (Tore River, Eastern Mongolia).

Description (figs. 49–52).—*Adult male;* U.S.N.M. No. 17516; Gensan, Korea; July, 1886; P. L. Jouy, collector. Head wide, snout rather rounded with well-marked canthal angle, loreal region scarcely concave; nostrils slightly nearer the eye than the tip of the snout, their distance from each other greater than their distance from the eye, equaling that from the labial edge and the upper eyelid, and somewhat greater than one-half the width of the interorbital space, which is rather concave; tympanum very distinct, nearly circular, about one-half the diameter of the eye, its distance from the latter nearly equaling its own diameter, and its distance from the labial border twice its diameter; parotoid glands large, their width more than one-half the length; fore legs long; fingers free at base, third longest, second shortest, slightly shorter than first and fourth, which are equal; two very distinct palmar tubercles, the outer more than twice as large as the inner, the latter with nuptial asperities; similar but larger pads on upper and inner side of first and second fingers, and a narrow band on inner side of third; heels not meeting when folded hind legs are placed perpendicular to the axis of the body; toes nearly fully webbed, the web extending as far as the end of the two basal phalanges of the third toe and the first basal phalanx of the fourth, but slightly excised; inner metatarsal tubercle moderate, with prominent cutting edge, considerably shorter than first toe; outer metatarsal tubercle slightly smaller, less prominent; no tarsal fold; double subarticular tubercles under all the fingers and under third and fourth toes; upper surface covered with numerous rounded tubercles of various sizes, which show a tendency to a symmetrical arrangement, one longitudinal series extending obliquely backward from the parotoid, while on the back between the parotoids there is a chevron-shaped figure pointing forward and a similar one on the lower back; the tubercles, many of which are larger than the tympanum, are surmounted by a conical brown point, becoming spiny on lower back and upper surface of legs; underside strongly granular or tubercular, with similar, though less developed, pointed asperities. Color (in alcohol) above pale grayish olive, with some ill-defined longitudinal vermiculating markings of an olive-buff color on both sides of back; a light band similarly colored from parotoids obliquely backward to groin and upper surface of limbs, with cross bands of the same tint; a dark slate-colored band from posterior angle of eye curving down over anterior lower portion of parotoid to insertion of arm, and a similarly colored spot on the posterior outer aspect of the gland, continuing backward below the lateral pale band and fading gradually into the

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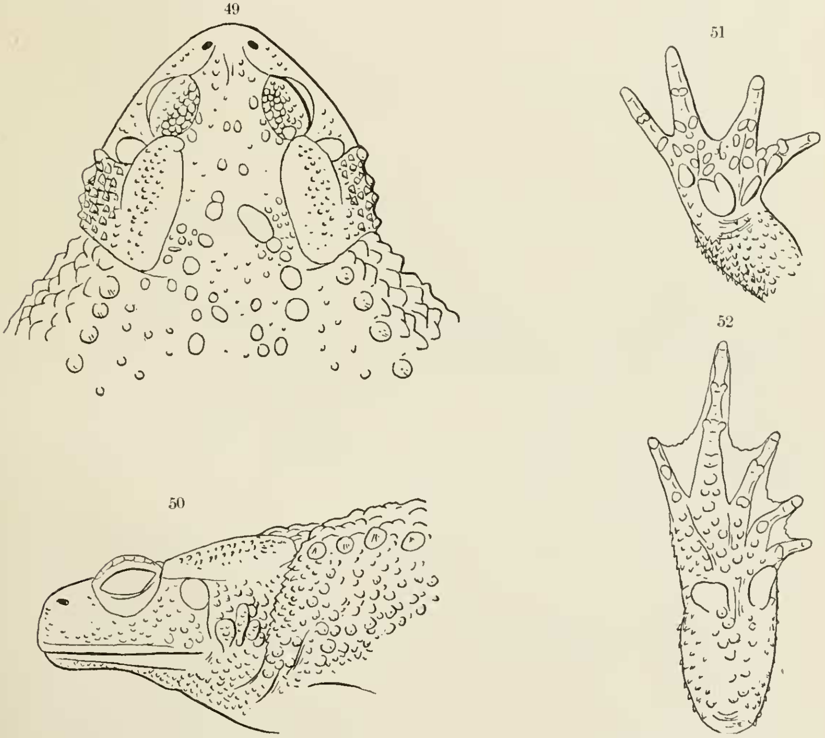
[a] *Rana bufo* Linnæus, Syst. Nat., 10 ed., 1758, I, p. 210.

[b] Signifying Asiatic.



Figs. 49–52.—Bufo bufo asiaticus. Nat. size. 49, top of head; 50, side of head; 51, underside of hand; 52, underside of foot. No. 17517, U.S.N.M.

general grayish olive; tubercles on upper surface topped with umber brown, and the upper surface of the parotoids vermiculated with the same color; underside uniform, unspotted pale ochre yellow, palmar and metatarsal tubercles, as well as nuptial pads, brown; edge of upper lip and lower edge of mandible slightly tinged with the same brown color, but no dusky line on the lower jaw.

Dimensions.

	mm.
Tip of snout to vent	84
Tip of snout to anterior border of tympanum	19
Nostril to tympanum	14
Internaral width	4
Interorbital width	7
Diameter of tympanum	3
Distance of tympanum from eye	2.5
Width of head	30
Fore leg	52
Hind leg from vent to tip of longest toe	110
Tibia	30
Hind foot from base of inner metatarsal tubercle to tip of longest toe	39
Length of parotoid	16
Width of parotoid	9

The *adult female* (U.S.N.M. No. 17517; same locality, date, and collector) (figs. 49–52) is larger; total length from snout to vent, 96 mm.; differs otherwise from the male chiefly in the somewhat shorter legs and in the tubercles of the skin being more pointed and more extensively pigmented, even on the underside all the tubercles being tipped with brown; that she lacks the nuptial excrescences on the fingers is a matter of course.

Another *adult female* (U.S.N.M. No. 21214; Seoul, Korea; P. L. Jouy, collector) is darker, the ground color above being brownish, and the pale markings clay color; the lower edge of the parotoids involved in a narrow black band, which continues for some distance backwards on the side, and a crescent-shaped branch descending from the middle of the parotoid to in front of the insertion of the arm; on the sides of the belly there are a number of small, black, isolated spots, none as large as the tympanum.

A *young* specimen, 41 mm. long, also from Korea (Chemulpo; Jouy, collector; U.S.N.M. No. 21215) is uniformly pinkish brown above and unspotted below, except a few blackish specks on throat and chest; there is a dusky bar descending from the eye to the edge of the lip and some indication of dusky markings on the upper lip and below the nostrils.

Habitat.—The northeastern continental representative of the European common toad (*Bufo bufo*) is found in eastern Mongolia, Manchuria, Amurland at least as far north as Khabarovka, Korea, northeastern China from Peking and Chefu to Shanghai, beyond which is found the southeastern representative, *B. bufo gargarizans.*

In Korea it has been found at Gensan, as well as at Chemulpo and Seoul. From Fusan we have thus far no records.

List of specimens of Bufo asiaticus.

U. S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected.
17516	Male[a]	Gensan, Korea	July, 1886	P. L. Jouy.
17517	Female[b]	do	do	Do.
21214	do.[c]	Seoul, Korea		Do.
21215	Young[c]	Chemulpo, Korea	Aug., 1883	Do.

[a] Description, p. 66. [b] P. 68; figs. 49-52. [c] P. 68.

BUFO BUFO JAPONICUS[a] (Schlegel).

1826. ?*Bufo praetextatus* Boie, Isis, 1826, p. 215; Bijdr. Natuurk. Wetensch., II, Pt. 1, 1827, p. 271 ("Nangasacki;" Blomhoff, collector).

1838. *Bufo vulgaris japonicus* Schlegel, Fauna Japon., Rept., pp. 106, 139 (type-locality, Japan; types in Mus. Leiden; Buerger and von Siebold, collectors; part).—Guenther, Cat. Batr. Sal. Brit. Mus., 1858, p. 56 (Japan).—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 109.

1858. *Bufo vulgaris* Bleeker, Natuurk. Tijdschr. Nederland Indië, XVI, p. 205 (Japan) (not of Laurenti).—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1876, p. 384 (Nagasaki).—Boulenger, Proc. Zool. Soc. London, 1880, p. 569 (part: Japan); Cat. Batr. Sal. Brit. Mus., 1882, p. 303 (part: Japan); Taill. Batr. Europe, Pt. 2, 1898, pp. 213, 347 (Kobe).—Okada, Cat. Vert. Jap., 1891, p. 66 (Japan).—?Fritze, Mitth. Deutsch. Gesell. Ost-Asiens, V, 1891, p. 239 (Yezo).

In structural characters and general proportions this island form is apparently identical with the foregoing and needs no special detailed description. Its status has been discussed above, and it was there pointed out that the only appreciable difference from the continental form is one of coloration, inasmuch as the Japanese form has the underside more or less strongly blotched and coarsely mottled with blackish, with a blackish line along the whole lower jaw, as in *Bufo formosus*.

Habitat.—The exact distribution of this form in Japan is highly problematical at the present time. Specimens from Kobe and Nagasaki seem to belong to it, but beyond this statement all is conjecture.

The occurrence of a toad in Yezo is reported by Doctor Fritze, and Doctor Nozawa writes me that he believes the toad is found in the southern part of this island, but it is impossible to say to what form it may belong. A comparison of Yezo and Sakhalin specimens would be highly interesting and instructive.

List of specimens of Bufo japonicus.

Museum.	No.	Age.	Locality.	When collected.	By whom collected.
Sci. Coll. Tokyo	74	Adult	Miyakoshima (?)		

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[a] Signifying Japanese.

BUFO RADDEI[a] Strauch.

1859. ? *Bufo variabilis* var. *amurensis* Maack, Putesh. na Amur (p. 153) (Amurland).

1859. *Bufo calamita* Maack, Putesh. na Amur, (p. 153) (Amur Valley), (not of Laurenti).

1876. *Bufo raddei* Strauch in Przewalski's Mongoliya i Strana Tungutov, II, Pt. 3, p. 53 (Chinese province of Ordos, and Alashan Desert).—Lataste, Rev. Intern. Sci. (Paris), I, 1878 (p. 437); Bull. Soc. Zool. France, V, 1880, p. 69 (Peking; Chefu).—Boulenger, Proc. Zool. Soc. London, 1880, p. 551 (Chefu; Amur).—Przewalski, Reisen in Tibet, 1884 (pp. 254, 257) (Gobi Desert, eastern part).—Boettger, Offenbach. Ver. Naturk. 24–25 Ber., 1885, p. 163.—Mueller, Verh. Naturf. Ges. Basel, VIII, Pt. 2, 1887, p. 258 (Khabarovka).—Stone, Proc. Phila. Acad., 1899, p. 183 (east. Mongolia).—Bedriaga, Przewalski Reise, Zool., III, Pt. 1, 1899 (p. 42, pl. i, figs. 1, 1*a*, 6).—Méhely, Zichy's Dritte Asiat. Forschungsr., II, 1901, p. 67 (North China between Daba and Khalgan; Peking).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg, (8) XVII, No. 1, 1905, p. 372 (Eastern Siberia, Tibet, Ordos, Amur province, etc.).

1882. *Bufo raddii* Boulenger, Cat. Batr. Sal. Brit. Mus., p. 294 (Sungatchi; Chefu); Ann. Mag. Nat. Hist. (6), V, Feb. 1890, p. 141 (Valley of the Amur; Dauria; Peking; Chefu).—Werner, Abh. Bayer. Akad. Wiss., (Muenchen) II Kl., XXII, Pt. 2, 1904, p. 359 (Tsingtau, China).

Description.—Adult male; U.S.N.M. No. 21394; Zagan Olui, Eastern Siberia (figs. 53–57).—Snout rounded, with indistinct canthus rostralis; loreal region but very slightly concave; nostrils nearly equidistant between eyes and tip of snout, their distance from each other slightly less than the width of the interorbital space; upper eyelid slightly wider than interorbital space; tympanum distinct, circular, its diameter about one-half that of the eye, distant from the eye about two-thirds its diameter; parotoid glands large, flat, of somewhat irregular outline, about twice as long as broad; fingers rather short, first and second subequal, fourth very short, not extending beyond the distal end of the basal phalanx of the third; two large palmar tubercles, the outer one especially very large and with a conspicuous central prominence; inner palmar tubercle as well as the first, second, and third fingers with pads of dark brown nuptial asperities; subarticular tubercles single, except one under first finger, which is semidivided; hind legs rather short; heels scarcely meeting when folded legs are placed at right angles to axis of body; toes about half webbed; subarticular tubercles single; inner metatarsal tubercle very prominent, much shorter than its distance from tip of first toe; outer metatarsal tubercle small but very distinct, prominent; a sharp cutaneous fold along the inner side of the tarsus from the inner metatarsal tubercle to the heel; a long prominent oval gland covering nearly the whole upper aspect of the tibia; skin coarsely granular above and below with numerous irregular glands of varying size on the back, those on either side of the median line and on the sides being rather elongate; an interior gular sac with one large opening on each side of the rather narrow tongue. Color (in alcohol) above brown with a paler median stripe; upper surface of legs with large dusky spots having narrow whitish margins; upper tip with a whitish line continued backwards to the glands back of the corner of the mouth; a conspicuous, sharply defined, longitudinal, oval blackish spot on the underside of the forearm: underside uniform pale.

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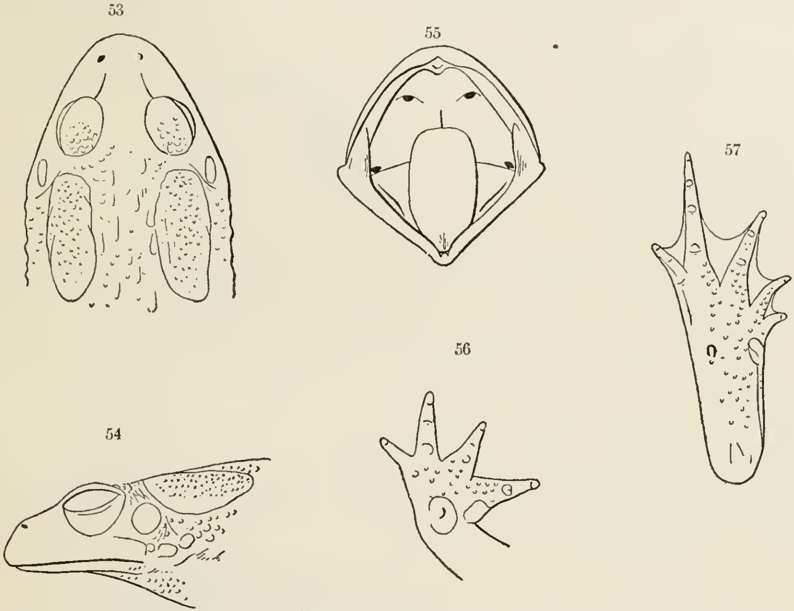
[a] For Dr. Gustav Ferdinand Richard Radde, late director of the museum in Tiflis, who in 1855–60 explored southeastern Siberia. Born in Dantzig, November 27, 1831; died in Tiflis, March 15, 1903.



FIGS. 53–57.—BUFO RADDEI. 1⅓ × NAT. SIZE. 53, TOP OF HEAD; 54, SIDE OF HEAD; 55, OPEN MOUTH; 56, UNDERSIDE OF HAND; 57, UNDERSIDE OF FOOT. NO. 21394, U.S.N.M.

Dimensions.

	mm.
Tip of snout to vent	55
Tip of snout to anterior border of tympanum	14
Nostril to tympanum	11
Internaral width	3.5
Interorbital width	4
Diameter of tympanum	3
Distance of tympanum from eye	2
Width of head	20
Fore leg	32
Hind leg from vent to tip of longest toe	66
Tibia	19
Hind foot from base of inner metatarsal tubercle to tip of longest toe	22
Length of parotoid	12
Width of parotoid	6

A *young* specimen, 27 mm. long, from Lake Khanka, Ussuri (U.S.N.M. No. 14343) also received from the St. Petersburg Academy, has the interorbital space much narrower, scarcely more than two-thirds the width of the upper eyelid, and the tympanum is much smaller, its diameter scarcely more than one-third the diameter of the eye. The color is very bright and the pattern very distinct; a brown line runs from nostril over canthus rostralis and the extreme outer edge of the uppper eyelid, bordered above by a pale olive line which on the tip of the snout joins a similar one occupying the entire median line of head and body above; a similarly pale line crosses the middle of the eyelids, and another one the occiput from tympanum to tympanum; parotoids pale olive with an irregular brownish figure in the outer posterior portion; all the larger glands on the back pale olive with a brownish outer edge forming ocelli; underside uniform pale with a few dusky spots on the belly.

The *females* lack the subgular sac and the nuptial asperities on the fingers. These excrescences persist in the male some time after the end of the breeding season.

Habitat.—This species which seems to occur from the eastern part of the desert Gobi, Alashan, and Ordos in Mongolia to Peking and Chefu in the south and north to Dauria, the valley of the Amur and the Ussuri country, is regarded by Boulenger as representing the European *Bufo calamita* in eastern Asia, and as a form intermediate between the latter and *Bufo viridis*. In the Hamburg Museum there is a specimen collected by Dieckmann in 1894 at Khabarovka, Amurland, and another from the same locality is in the Basel Museum. Stone has recorded it from a lake near Lama-mio and various other localities in eastern Mongolia.

List of specimens of Bufo raddei.

U.S. N.M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
14343	Young [a]	Lake Khanka, Ussuri		Acad. Sci. St. Petersburg.
21394	Male [b]	Zagan, East Siberia		Do.

[a] P. 72. [b] Description, p. 70; figs. 53–57.

BUFO MELANOSTICTUS[a] Schneider.

1799. *Bufo melanostictus* Schneider, Hist. Amph., I, p. 216 (India orientalis).—Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 306 (South China; East Indies); Fauna Brit. India, Rept., 1890, p. 505, fig. p. 506.—Boettger, Offenbach. Ver. Naturk. 24–25 Ber., 1885, p. 131 (Canton; Prov. Quangtung, China).—Flower, Proc. Zool. Soc. London, 1896, p. 911, pl. xliv, fig. 3 (tadpole).—Stejneger, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 216 (*meranostictus* err. typ.) (Taipa and Giilan, Formosa.)

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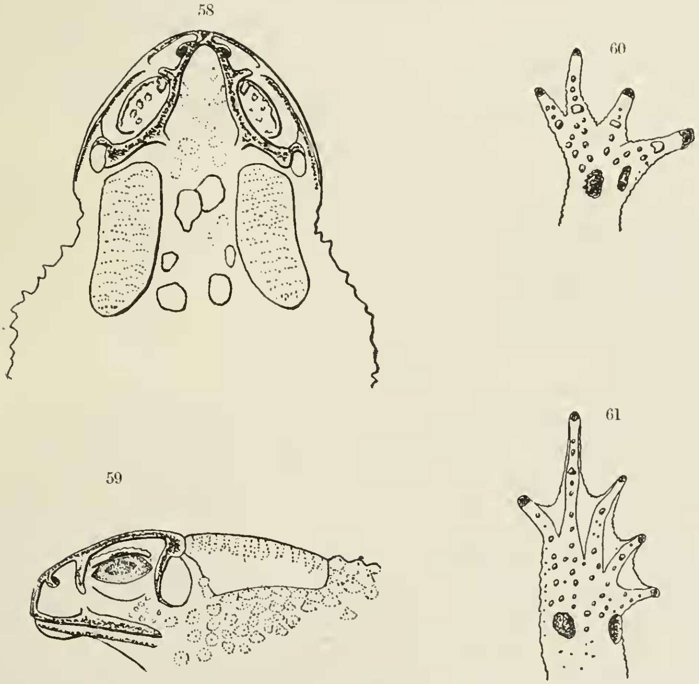
[a] From μέλας, black; στικτός, spotted.

The numerous synonyms based upon Indian and Malayan specimens are omitted here.

Description (figs. 58–61).—*Adult female;* U.S.N.M. No. 36498; Sic. Coll. Mus., Tokyo, No. 26*a*; Taipa, Formosa; September, 1896; Tsunasuke Tada, collector. Head with strongly developed bony crests, involving the upper lip, a rostral ridge on end of snout from lip to between nostrils, there bifurcating and continuing on canthus rostralis, along supraorbital border to above the tympanum, forming there a knob-like prominence and sending a branch downward along the anterior border of the tympanum; a slight parietal spur indicated, also a short anteorbital spur or crest; nostrils nearer the tip of the snout than the eye; interorbital space deeply concave, much wider than upper eyelid, which is strongly tubercular and with thickened glandular edges; tympanum vertical, oval or almost pear-shaped, separated from the orbit by a very narrow space, its longest diameter about three-fourths the diameter of the eye; parotoids large, swollen, kidney-shaped; first finger reaches considerably beyond second which does not quite reach as far as fourth; an elongate inner and a much larger outer palmar tubercle; subarticular tubercles single, prominent; palm, underside, and edges of fingers with numerous pointed tubercles, which, like all the other digital tubercles and the



Figs. 58–61.—Bufo melanostictus. Nat. size. 58, top of head; 59, side of head; 60, underside of hand; 61, underside of foot. No. 36498, U.S.N.M.

horny tip of the fingers, are blackish brown; heels just meeting when hind legs are placed at right angles to axis of body; metatarsal tubercles reaching posterior corner of eye when hind legs are placed forward along the sides of the body; toes less than one-half webbed, the webs being greatly excised and their edges sharply denticulate; inner metatarsal tubercle prominent, oval, shorter than first toe, outer one large, rounded, less prominent; the single subarticular tubercles, plantar tubercular asperities, and tip of toes like those on the fore foot; skin strongly tubercular, the tubercles on the back larger, more distant, glandular, rounded, those on sides and limbs more prominent, almost conical, all with a horny dark-brown tip, which on sides and limbs becomes spinous. Color (in alcohol), clay-colored above, more pure pale ocher-yellow underneath, all the crests and nearly all the tips of the tubercles dark brown, as are also the elevated fine vermiculations on the surface of the parotoids; indistinct dusky spots and coarse vermiculations on limbs, sides, throat, and breast.

Dimensions.

	mm.
Tip of snout to vent	84
Tip of snout to anterior border of tympanum	20
Nostril to tympanum	16
Internaral width	5
Interorbital width	8.5
Longest diameter of tympanum	5.5
Width of head	31
Fore leg	50
Hind leg from vent to tip of longest toe	99
Tibia	26
Hind foot from base of inner metatarsal tubercle to tip of longest toe	30
Length of parotoid	20
Width of parotoid	8

The *adult male* appears to be smaller, U.S.N.M. No. 36499, measuring only 61 mm. from snout to vent, but in proportions and otherwise similar to the female, except that the webs between the toes are considerably smaller, and the outer metatarsal tubercle is smaller than the inner. It has also distinct traces of nuptial asperities on top of the first finger, probably only remnants from the breeding season, during which such excrescences are present on first and second fingers. A small internal subgular sac, entrance slits to which are seen on each side of the tongue. The dark color markings are somewhat more distinct.

A *halfgrown* specimen (Sci. Coll. No. 26*e*) measuring 46 mm. is very similar, but the skin is much less rough except on hands and feet; the interorbital space is flat, but all the cranial crests are plainly developed except the preauricular; the tips of the fingers are pale, and the dusky brown spots and vermiculations on throat, chest, and anterior portion of abdomen very strong and well defined; lips similarly blotched with dark brown.

Habitat.—Widely distributed through India, Ceylon, Burma, the Malayan peninsula and archipelago to southern China and Formosa. Boulenger states that in the Sikhim Himalayas it ascends to about 10,000 feet and in the Nilgiris to 7,000 feet.

In Formosa it seems to be common, as Mr. Tada collected many specimens at Taipa and Giilan during September and October, 1896. There are two specimens in the British Museum from Taiwan fu, collected by Holst.

List of specimens of Bufo melanostictus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
Sci. Coll. Tokyo	26*c*	Male	Taipa, Formosa	Sept.—, 1896	T. Tada.
Do	26*d*	Female	do	do	Do.
Do	26*e*	Halfgr.[a]	do	do	Do.
Do	25*a*		Giilan, Formosa	Oct., 1896	Do.
Do	25*b*		do	do	Do.
Do	25*c*		do	do	Do.
Do	25*d*		do	do	Do.
U.S.N.M	34329		Taipa, Formosa	Mar., 1903	A. Owston.
Do	36498	Female[b]	do	Sept., 1896	T. Tada.
Do	36499	Male[a]	do	do	Do.
Do	36500		Giilan, Formosa	Oct., 1896	Do.

[a] Description, p. 74.

[b] Description, p. 73, figs. 58-61.

Family HYLIDÆ.

The tree-toads are characterized by the presence of teeth in the upper jaw, or in both upper and lower jaws, combined with an arciferous shoulder-girdle and dilated sacral lateral processes; bone of last toe-joint claw-shaped.

A large family of wide distribution, though not occurring in the Ethiopian region. The greatest number of species is found in tropical America and in Australia, but only a few in Asia and Europe. Most of the forms are arboreal with the tip of the digits enlarged into a disk, which is more or less sticky. Some are modified to such an extent for life among the trees that they lay their eggs in water collected in holes in trunks and branches of trees.

Only one genus is represented in eastern Asia.

Genus HYLA[a] Laurenti.

1768. *Hyla* Laurenti, Synops. Rept., p. 32 (type, *H. viridis*).
1799. *Calamita* Schneider, Hist. Amph., I, p. 151, comp. p. 174 (type, *C. arboreus*).

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[a] Not derived from the Greek word ὕλη, wood-land, copse, as commonly stated, but from the vocative of Hylas, in Greek mythology the favorite of Hercules, who lost him in Bithynia, the crying of *hyla*, *hyla* being part of the religious ceremonies instituted in his honor. The croaking of the tree-toad suggested to Laurenti the fanciful idea of its being Hyla's priest, and thus meriting his name, "hæc quasi Hylæ sacerdos nomen ejusdem merita est."

1814. *Hylaria* Rafinesque, Specchio Sci. (Palermo), II, fasc. 7 (substitute for *Hyla*).
1825. *Boana* Gray, Ann. Philos. (n. s.), X, p. 214 (type, *Rana boans*).
1826. *Calamita* Fitzinger, Neue Classif. Rept., p. 38 (type, *Rana caerulea* White).
1827. *Rhacophorus* "Kuhl" Schlegel, Isis, 1827, p. 294 (type, *H. palmata;* not of Tschudi, 1838).
1830. *Calamites* Wagler, Syst. Amph., p. 200 (emendation of Fitzinger's *Calamita*).
1830. *Auletris* Wagler, Syst. Amph., p. 201 (type, *H. boans*).
1830. *Hyas* Wagler, Syst. Amph., p. 201 (type, *H. arborea;* not of Leach, 1815).
1830. *Scinax* Wagler, Syst. Amph., p. 201 (type, *H. aurata*).
1830. *Dendrohyas* Wagler, Syst. Amph., p. 342 (substitute name for *Hyas*, preoccupied).
1843. *Lobipes* Fitzinger, Syst. Rept., p. 80 (type, *H. palmata*).
1843. *Dryophytes* Fitzinger, Syst. Rept., p. 31 (type, *H. versicolor*).
1885. *Epedaphus* Cope, Proc. Amer. Philos. Soc., 1885, p. 383 (type, *H. gratiosa*).
1899. *Hyliola* Mocquard, Nouv. Arch. Mus. Paris (4), I, p. 337 (type, *H. regilla*).

The list of synonyms is considerably larger than the above, which includes mostly such names only as are based upon species occurring within the faunal area here treated of, or constitute corrections or additions to the synonymy as commonly given.

The tropical genus *Hyla*, as now understood, is American and Australian in its distribution, and embraces considerably over 200 species, less than 3 per cent of which occur in the Old World. The species, or forms, which are found in the mainland of Eurasia, viz, *H. annectens* and *H. simplex*, with the ones treated of in this work, constitute a closely related group[a] extending from Great Britain to Japan, south to northeastern India and Annam.

The forms which are to occupy us in this connection may be distinguished as follows:

KEY TO THE JAPANESE, KOREAN, AND FORMOSAN SPECIES OF HYLA.

a^1 No deep black spots on sides or legs.
  b^1 Digital disks equaling inner metatarsal tubercle.
    c^1 A distinct blackish stripe between nostril and eye. *H. arborea japonica*, p. 76
    c^2 No blackish stripe between nostril and eye...... *H. arborea immaculata*, p. 82
  b^2 Digital disks much smaller than inner metatarsal tubercle..... *H. stepheni*, p. 84
a^2 Sides of body and posterior aspect of hind limbs with deep black spots. *H. chinensis*, p. 86

HYLA ARBOREA [b] JAPONICA [c] Guenther.

Plate IX, figs. 1–3.

1838. *Hyla arborea* Schlegel, Fauna Jap. Rept., pp. 112, 136, 139; Saur. et Batr., pl. III, figs. 5[d], 6 (not of Linnæus) (Japan).—Hilgendorf, Sitz. Ber. Berlin Ges. Naturf. Fr., 1880, no. 8, p. 120 (Hondo; Yezo).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, 1891, p. 239 (Yezo).

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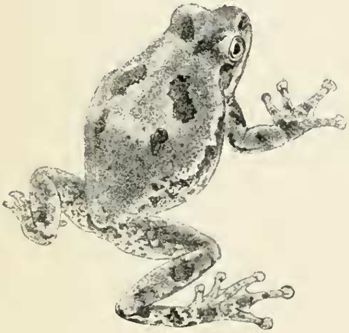
[a] In turn related to *Hyla eximia* of Mexico.

[b] Signifying arboreal.—*Rana arborea* Linnæus, Syst. Nat., 10 ed., I, 1758, p. 213.

[c] Signifying Japanese.

[d] Reproduced in this work on Plate IX, fig. 3.



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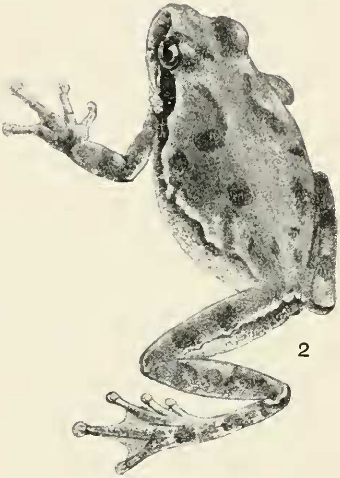

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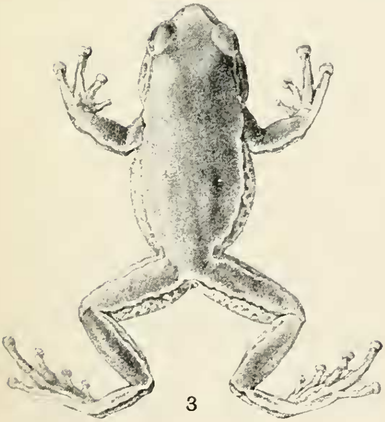

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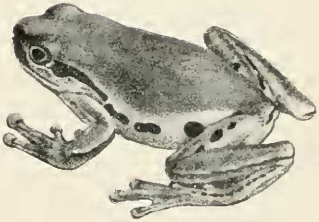

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Figs. 1-3, Hyla arborea japonica; Fig. 4, H. chinensis. (From Boulenger, Schlegel, and Guenther.)

For explanation of plate see page 554.

1858. *Hyla viridis* var. *japonica* GUENTHER, Cat. Batr. Sal. Brit. Mus., p. 81.
1858. *Hyla arborea* var. *japonica* GUENTHER, Cat. Batr. Sal. Brit. Mus., p. 109 (type-locality, Japan; types in Brit. Mus.).—BOETTGER, Offenbach. Ver. Naturk., 17–18 Ber., 1878, p. 8 (Japan); Kat. Batr. Mus. Senckenberg., 1892, p. 43 (Hakone; Goto Isl.); Ber. Senckenberg. Naturf. Ges., 1894, p. 141.—BOULENGER, Cat. Batr. Sal. Brit. Mus., 1882, p. 381 (Japan); Proc. Zool. Soc. London, 1887, p. 578, pl. LI, fig. 2 (Port Hamilton, Korea).—BEDRIAGA, Bull. Soc. Natural. Moscou (n. s.), III, no. 3, 1889, pp. 475, 487 (Tokyo; Yezo).—OKADA, Cat. Vert. Jap., 1891, p. 66 (Tokyo).—SCLATER, Batr. Ind. Mus., 1892, p. 32.
1860. *Hyla viridis?* HALLOWELL, Proc. Phila. Acad., 1860, p. 500 (Simoda).
1878. *Hyla arborea* var. *meridionalis* BOETTGER, Offenbach. Ver. Naturk. 17–18 Ber., p. 8 (Japan) (not of 1874).
1879. *Hyla japonica* CAMERANO, Atti Accad. Torino, XIV, Pt. 5, Apr. 1879, p. 895 (Tokyo).
1887. *Hyla arborea* var. *savignyi* BOULENGER, Ann. Mag. Nat. Hist. (5), XIX, 1887, p. 67 (Gensan, Korea) (not of Audouin); Taill. Batr. Europe, Pt. 2, 1898, p. 250 (part), pl. XV, fig. 5 (Tsu-shima), fig. 6 (Daibutsu).[a]
1905. *Hyla stepheni* NIKOLSKI, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, p. 401 (part: Yezo) (not of Boulenger?).

Schlegel's fig. 5 on Plate III[b] of the Saurii and Batrachii of Fauna Japonica is usually referred to *Polypedates schlegelii*, but I think erroneously. The webbing between the digits and the shape of the snout, as well as the coloration, indicate *Hyla arborea*. Moreover, an examination of the specimen in Leiden Museum shows that this view is correct.

In his catalogue of the tailless batrachians in the British Museum (1882) Boulenger recognized four varieties of *Hyla arborea*, of which *H. arborea savignyi* was credited to various islands in the Mediterranean, parts of western Asia, and to the island of Hainan, South China (a single half-grown specimen), while *H. arborea japonica* was represented as being confined to Japan. In 1887 (July) he recorded[c] a specimen of the latter from Port Hamilton, a small island at the south end of Korea, opposite Kiusiu, found together with another specimen which he described as *Hyla stepheni*. Shortly before (January, 1887) he had referred a specimen from Gensan, Korea, to *H. arborea* var. *savignyi*,[d] a reference, by the way, which appears to have escaped Doctor von Bedriaga.[e] While the latter author, as well as Boettger[f] still recognize *H. arborea japonica*, Boulenger in his latest important work[g] after the study of a large series of specimens (34 from the Mediterranean and western Asia as far as the Persian Gulf and 18 from Japan, Korea, and China) pronounce them all *H. arborea savignyi.* From the text (pp. 250–251) it is evident that his reason for this is that there are spotted specimens found in the western series as well as unspotted ones among those from eastern Asia. It is quite possible that the unspotted specimens may be somewhat difficult to distinguish, but in the spotted ones the angular shoulder spots of the Japanese and Korean specimens seem to be almost diagnostic. In our plain-colored specimens, moreover, I can always detect dusky bars across the tarsus, and I would also call attention to the dark spot on the upper lip under the anterior portion of the eye which is found in many of the eastern specimens. Under these circumstances I think it preferable to follow Boettger in maintaining the old status of *H. arborea japonica* as a distinguishable form.[a]

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[a] Reproduced in this work on Plate IX, figs. 2, 1.

[b] Reproduced in this work on Plate IX, fig. 3.

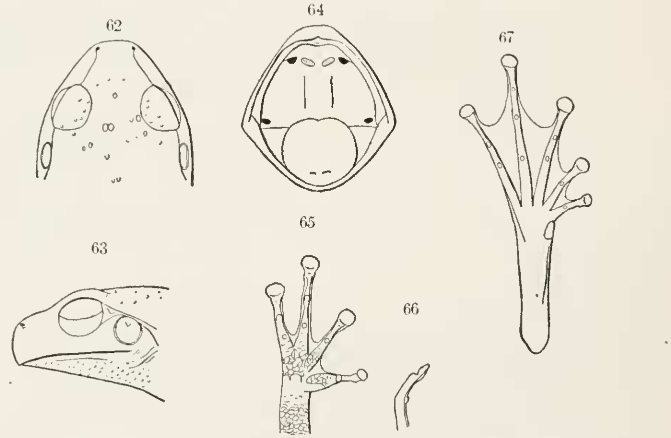
[c] Proc. Zool. Soc. London, 1887, p. 578.

[d] Ann. Mag. Nat. Hist. (5), XIX, Jan. 1887, p. 67.

[e] Bull. Soc. Nat. Moscou, (n. s.) III, 1889.

[f] Kat. Batr. Mus. Senckenb., 1892, and Ber. Senckenb. Naturf. Ges., 1894.

[g] Taill. Batr. Europe, II, 1897.



Figs. 62–67.—HYLA ARBOREA JAPONICA. 1½ × NAT. SIZE. 62, TOP OF HEAD; 63, SIDE OF HEAD; 64, OPEN MOUTH; 65, UNDERSIDE OF HAND; 66, TOP OF FINGER, SIDE VIEW; 67, UNDERSIDE OF FOOT. NO. 23542, U.S.N.M.

Description (figs. 62–67).—*Adult female;* U.S.N.M., No. 31926; Kochi, Province of Tosa, Shikoku; May 11, 1903; Dr. Hugh M. Smith, collector. Vomerine teeth in two nearly straight, short series between the choanæ; tongue large, broadly oval, somewhat truncate behind, with a slight median incision; nostrils somewhat nearer the tip of the snout than the eye, their distance from each other shorter than their distance from the labial edge, and still shorter than the interorbital width, which is considerably greater than the upper eyelid: tympanum nearly circular, its diameter about one-half that of the eye, its distance from the latter greater than from the corner of mouth; fingers distinctly webbed at base, first shortest, fourth longer than second, third longest; disks of fingers slightly larger than those of toes, nearly as large as tympanum; hind feet rather long, tarso-metatarsal joint reaching considerably beyond tip of snout and heel joint reaching to middle of eye when legs are carried forward along the side of the body; heels just touch when folded legs are placed vertical to the axis of the body; toes webbed slightly more than one-half; third toe as long as fifth; inner metatarsal tubercle oval, prominent, about the size of the disk of the longest toe; no outer metatarsal tubercle; subarticular tubercles under fingers and toes prominent; skin above smooth; below granular, except on inner side of tibia; a strong glandular fold from eye, curving downward behind the tympanum to the insertion of the fore leg; a strong dermal fold across the chest from axilla to axilla. Color (in alcohol) about smoke gray (in life bright green), with dusky markings as follows: A Y-shaped rostral stripe on the end of the snout, connected below with an undulating blackish line, forming the edge of the upper jaw, the diverging upper branches reaching the nostrils and continuing behind these through the eye and over the tympanum as a dark stripe, edged above with whitish; on the tympanum it widens so as to embrace the whole of this organ, and continues backward over the shoulder along the flanks as an irregular broad band, which in the groin is replaced by coarse vermiculation of blackish and white; a dusky spot between lower anterior portion of eye to edge of lip; a pair of dusky spots, one on each upper eyelid, converging, though not meeting, backward; a large angular, L-shaped mark on each shoulder, and a smaller, more irregular spot on each side of the lower back, descending toward the groin, but not connected with the dusky band of the flanks; on the coccyx several smaller irregular blotches; a spot in front of the upper end of humerus, a narrow dusky line along the posterior outline of the arm; posterior aspect of femur brownish gray with distinct rounded white spots; upper aspect of fore leg and hind legs, including tarsus, with distinct dusky crossbars; lower lip whitish, with a series of dark spots; underside whitish, with numerous small dusky spots on throat.

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[a] What is *Hyla cyanea* Hallowell, Proc. Phil. Acad., 1860, p. 494, from "Loo Choo"? All he says is: "*Hyla cyanea* Daudin (young). One specimen." There is great confusion in this paper of Hallowell's (for instance, *Polypedates viridis* and *burgerii*, p. 501, under Japan instead of Loo-Choo; *Ophthalmidium tenue*, p. 497, from Hongkong, China, under Japan), and it is quite possible that this reference to a young *Hyla cyanea* is only a duplication of the Australian record, p. 490: "Hyla cyanea Daud. One specimen. Sidney (young). Taken Dec., 1853," which got misplaced. I may add that Boulenger refers it with a query to *Rhacophorus viridis* (Proc. Zool. Soc. London, 1887, p. 149).

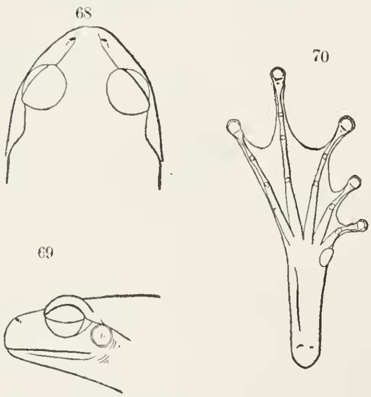
Dimensions.

	mm.
Tip of snout to vent	37
Tip of snout to anterior border of tympanum	9.5
Nostril to anterior border of tympanum	8
Internaral width	3
Interorbital width	4
Diameter of tympanum	2

	mm.
Width of head	12
Fore leg	23
Hind leg from vent to tip of longest toe	57
Tibia	16.5
Foot from base of inner metatarsal tubercle to tip of longest toe	18
Inner metatarsal tubercle	2

The *adult male* has a large external, dark-pigmented, vocal sac under the throat, folding up with longitudinal folds when not inflated. The males of U.S.N.M. No. 7428, which were collected by Dr. Wm. Stimpson, at Simoda, in May, 1855, consequently during the breeding season, have a large and distinct pad of nuptial asperities on the upper side of the base of the first finger, but they are not distinguished from the adjacent skin by any different coloration. The color of these specimens, which have the back unspotted, is described from life by Stimpson as being "bright light green above; a golden band along each side of the head, including the eye; sides minutely sprinkled with copper color; belly white."

Variation.—In the series before me the structural and proportional characters, such as the size and shape of the vomerine series of teeth, the size of tympanum, digital disks, and metatarsal tubercle, vary within certain limits. The length of the foot is found to vary considerably in a few specimens, apparently without being correlated with any other difference. It is in the coloration, however, that we meet with the greatest amount of variation. Not only are many of the specimens entirely uniform above, but the lateral stripe is scarcely indicated in a large number, and the mark on the tip of the snout is absent in most. The dusky spot beneath the eye is present in a majority, and the crossbars on the tarsus are visible in all the specimens which are not so faded from age as to have lost nearly all trace of markings. In the specimens with dorsal spots the angular shoulder mark is usually present, but in No. 23542, at least, there is a longitudinal stripe on each side of the back, caused by a fusion of the two dorsal spots and the obliteration of the transverse branch of the anterior mark.



FIGS. 68–70.—HYLA ARBOREA JAPONICA. 1½ × NAT. SIZE. 68, TOP OF HEAD; 69, SIDE OF HEAD; 70, UNDERSIDE OF FOOT. NO. 21211, U.S.N.M.

Habitat.—The tree-toad, a name probably preferable to that of tree-frog, which may properly be restricted to the genus *Polypedates* (or *Rhacophorus* of many authors), occurs all over Japan proper in suitable stations. It is hardly necessary to enumerate specific localities, though the following are represented by specimens in various museums: In Kiusiu: Yamagawa and Miyazaki (U.S.N.M.), Mount Onsen in Shimabara (Brit. Mus.); in Shikoku: Kochi (U.S.N.M.); in Hondo: Nara, Koriyama, Simoda, Mount Fuji, and Yokohama (U.S.N.M.), Kobe, Kiga, Daibutsu (Brit. Mus.), Setsu (Hamburg Mus.), Hakone (Senckenberg Mus.): in Yezo: Hakodate and Sapporo (U.S.N.M.). There are also in British Museum specimens from Tsu-shima collected by Holst, and in Museum Senckenbergianum one specimen from Goto Island, near Nagasaki.

There is no record of the species in any of the Riu Kiu Islands or Formosa.

Outside of Japan it occurs in Korea, whence specimens are in the United States National Museum (Fusan) and in the British Museum (Gensan and Seoul); the Hamburg Museum also has specimens from southern Korea, collected by Doctor Warburg. One specimen was brought from Port Hamilton by Mr. G. Stephen, together with the type of *Hyla stepheni.*

The status of the Chinese specimens which have been referred to this form is too uncertain to detain us here. It may be sufficient to refer to what is said under the heading of *Hyla arborea immaculata,* with the additional remark that the Hainan specimen belongs to the recently described *Hyla simplex*[a] as suggested by Doctor Boettger.

List of specimens of Hyla arborea japonica.

U. S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
7428*a*	Male[a]	Simoda, Izu, Hondo	May, 1855	Wm. Stimpson.
7428*b*	....do	....do	....do	Do.
7428*c*	....do	....do	....do	Do.
7428*d*	....do	....do	....do	Do.
7428*e*	Female	....do	....do	Do.
7492*a*	Young	Hakodate, Yezo		Do.
7492*b*	....do	....do		Do.
11345	....do	Japan	1878	E. S. Morse.
11346	....do	....do	1878	Do.
17511	Female	Fusan, Korea	1885	P. L. Jouy.
21211	....do[b]	(Seoul?), Korea	1883	Do.
21212	Young	....do	1883	Do.
23441	....do	Sapporo, Yezo	1896	Nozawa.
23442	....do	....do	1896	Do.
23443	....do	....do	1896	Do.
23444	....do	....do	1896	Do.
23445	....do	....do	1896	Do.
23542	Female[c]	Yokohama, Hondo	Sept., 1896	L. Stejneger.
23588	....do	....do	....do	Do.
23907	....do	Onogami, Gunba		I. Ijima.
23908	Halfgrown	....do		Do.

[a] Description, p. 80. [b] Figs, 68–70; see also p. 85. [c] Figs. 62–67; see also p. 85.

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[a] *Hyla chinensis* var. *simplex Boettger*, Ber. Senckenberg. Naturf. Ges., 1901, Abh., p. 53.

List of specimens of Hyla arborea japonica—Continued.

U. S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
30742	Female	Miyazaki, Hiuga, Kiusiu		C. A. Clark.
30743	Male	do		Do.
31803	Halfgrown	Nara, Yamato, Hondo	Apr., 1903	H. M. Smith.
31805	do	Koriyama, Yamato, Hondo	Apr. 26, 1903	Do.
31806	do	do	do	Do.
31807	do	do	do	Do.
31825	Male	Yamagawa, Satsuma, Kiusiu	June 14, 1903	Do.
31826	Young	do	do	Do.
31827	do	do	do	Do.
31913	Male	Kochi, Toza, Shikoku	May 11, 1903	Do.
31914	Female	do	do	Do.
31915	do	do	do	Do.
31916	Male	do	do	Do.
31917	Female	do	do	Do.
31918	Male	do	do	Do.
31919	do	do	do	Do.
31920	do	do	do	Do.
31921	do	do	do	Do.
31926	Female[a]	do	do	Do.
34374	Male	Mount Fuji, Hondo	Summer, 1898	A. Owston.
34375	do	do	do	Do.
34376	Female	do	do	Do.
34377	do	do	do	Do.
34378	Male	do	do	Do.
34379	Female	do	do	Do.
34380	do	do	do	Do.
34381	Male	do	do	Do.
34382	Female	do	do	Do.
34383	do	do	do	Do.
34384	do	do	do	Do.
34385	do	do	do	Do.
34386	do	do	do	Do.
34387	do	do	do	Do.
34388	do	do	do	Do.
34389	do	do	do	Do.

[a] Description, p. 78.

[HYLA ARBOREA IMMACULATA[a] Boettger.]

1888. *Hyla chinensis* var. *immaculata* BOETTGER, Ber. Senckenberg. Naturf. Ges., 1888, Abh., p. 189 (type-locality, Shanghai; type in Mus. Senckenberg.; Schmacker, collector).—STONE, Proc. Phila. Acad., 1899, p. 184 (Tore River, eastern Mongolia).

1892. *Hyla arborea* var. *immaculata* BOETTGER, Kat. Batr. Mus. Senckenberg., p. 43 (Shanghai; Lueshan Mts., near Kiukiang); Ber. Senckenberg. Naturf. Ges., 1894, p. 140 (Lueshan).

This form which Boettger originally referred to *Hyla chinensis* as a variety he has since associated with *H. arborea*. According to his revised view of 1894[b] it is most nearly related to *H. arborea japonica*, from which "it may be easily separated by the following characters: No web between the outer fingers; toes one-third webbed; no dark loreal stripe," while *H. arborea japonica* has "one-fourth web between third and fourth finger; toes one-half webbed, and an always distinct dark loreal stripe. In the proportion between the length of the tibia to that of the femur there may also be a slight difference. In var. *immaculata* the tibia appears to be somewhat longer than the femur; in var. *japonica*, on the contrary, the femur is longer than the tibia."

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[a] Signifying Unspotted.

[b] Ber. Senckenberg. Naturf. Ges., 1894, p. 141.

I have not seen any specimens of this form from the type locality and therefore can not express any opinion as to its validity, but if the three specimens from Mongolia, which Mr. Witmer Stone somewhat doubtfully referred to this form, really belong to it, it would appear that the characters assigned to it are somewhat unstable and unreliable.

Thanks to the kindness of the authorities of the Philadelphia Academy, I was recently permitted to examine the three specimens alluded to above, namely, Nos. 4943–4945, collected by Doctors Smith and Furness at Tore River, Mongolia.

No. 4945, which is adult, differs from a German specimen, with which I could compare it, by being entirely immaculate, with no trace of canthal or postocular streaks or dusky crossbars on the legs. The foot is somewhat shorter and the webs slightly larger; the heels do not meet by a space of 2 mm. when the folded hind legs are placed vertical to the axis of the body, and they do not reach the axilla when the leg is extended along the side of the body.

No. 4944, also adult, has relatively longer hind legs, as the heel reaches the posterior border of the eye. A canthal and postocular line can be distinctly traced, also some spots on the upper lip, and apparently faint cross markings on the legs.

No. 4943, which is quite young, is nearly unspotted like No. 4945, but with trace of a subocular spot on one side and of cross markings on legs.

The following *measurements* were taken of the two adults to show the difference in the relative length of the hind legs:

	No. 4945.	No. 4944.
	mm.	*mm.*
Snout to vent	40	39
Vent to tip of longest toe	49	59
Heel to tip of longest toe	25	27

The status of the tree-toad of northern China is consequently still doubtful. It seems to be fairly distinct from the Japanese form, however, in the *relatively* immaculate coloration.

Habitat.—Boettger originally recorded this form from Shanghai and later from the Lueshan Mountains near Kiukiang on the Yangtse-kiang, where it occurs together with *Hyla chinensis.* Three Mongolian specimens, from the Tore River, have been referred to this form doubtfully, as detailed above.

List of specimens of Hyla immaculata.

Phila. Acad. No.	Age.	Locality.	When collected.	By whom collected.
4943	Young[a]	Tore River, Mongolia		Drs. Smith and Furness.
4944	Adult[a]	do		Do.
4945	do.[a]	do		Do.

[a] P. 83.

HYLA STEPHENI[a] Boulenger.

1887. *Hyla stepheni* Boulenger, Proc. Zool. Soc. London, 1887, p. 579, pl. li, fig. 1 (type-locality, Port Hamilton, Korea); Ann. Mag. Nat. Hist. (6), V, Feb. 1890, p. 142 (Ussuri River); Proc. Zool. Soc. London, 1890, p. 326.—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1, 1905 (part: Ussuri, etc.).

This species was described by Boulenger from a specimen collected at Port Hamilton, together with a specimen of true *H. arborea japonica.* It is professedly nearly allied to *H. arborea,* and no comparison with the latter accompanies the description.

Later on (1890) he records two specimens from the Ussuri River of which he gives the measurements and says that the species "is easily distinguished from *H. arborea* by the much larger and more prominent metatarsal tubercle." The length of the inner toe is given as 4 mm. and that of the metatarsal tubercle as 2.5 mm.

Through the kindness of the authorities of the British Museum, I was able to examine these specimens during my visit in 1898.

The type (Brit. Mus. 89.11.8.5) is in very poor condition (dried up) and nothing can be made of it. The two other specimens, however, referred by Boulenger to this species (Brit. Mus. 89.12.16.197.7), collected by Doerries at the Middle Ussuri in 1886 (Fischer collection Nos. 754–5), are in very good condition and, compared with the Hondo specimens of *H. japonica* then in the British Museum, show a difference in the relative size of disks and metatarsal tubercle as follows:

Digital disks much smaller than inner metatarsal tubercle	*H. stepheni*
Digital disks equaling metatarsal tubercle	*H. japonica*

In the latter, moreover, the ventral granulation is considerably finer.

Whether the Ussuri specimens are identical with the Port Hamilton type is now hard to determine, but we will have to accept Boulenger's identification as correct.

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[a] For Mr. George Stephen, R. N., who collected the type.

A single specimen in the United States National Museum (No. 21211, Figs. 68–70), collected by Jouy in Korea in 1883, probably in Seoul, has a somewhat larger inner metatarsal tubercle than the other specimens from Korea and Japan, and while the snout is possibly a trifle shorter, the hind legs are not short, the tibio-tarsal articulation reaching the front of the eye; finally, the ventral granulation is exactly as in the typical *Hyla japonica*. At first I thought that the hind foot of this individual might afford a good character, it being considerably larger than in most of my Japanese specimens, but one collected by myself at Yokohama, in 1896, is so nearly like it that I do not venture to separate them.

Altogether I am not assured of the distinctness of *H. stepheni*, my faith in it having been considerably shaken by the last-mentioned specimen (U.S.N.M. No. 23542, figs. 62–67). However, having been favorably impressed by the examination of the Ussuri specimens, and not now having an opportunity to reexamine them in connection with my own material, I do not feel warranted in disturbing the status given them by Boulenger.

Nikolski, in 1905, has referred the tree-toads in the St. Petersburg Museum from Yezo, collected by Albrecht in 1865 and by Maximovitch, to *H. stepheni*, apparently as distinct from the tree-toads of southern Japan. I have not been able to accept this view, as I have been unable to discover any tangible difference between the Hylas on both sides of Tsugaru Strait, but Nikolski's action goes to show how unsatisfactory the whole question is as yet. Much more material will be necessary before it can be settled.

There being no undoubted specimen of this form in our museum, I reproduce herewith Boulenger's original description and his measurements of the two Ussuri specimens.

Original description of type-specimen.—Brit. Mus. No. 89.11.8.5; Port Hamilton, Korea; G. Stephen, collector.—Near *H. arborea.* Tongue subcircular, slightly nicked, and free behind; vomerine teeth in two slightly oblique series between the choanæ; head a little larger than that of *H. arborea*, broader than long; snout rounded, shorter than the diameter of the orbit; canthus rostralis distinct; loreal region slightly concave; interorbital space as broad as the upper eyelid; tympanum distinct, half the diameter of the eye; fingers with a short web at the base; no projecting rudiment of pollex; toes hardly two-thirds webbed; disks a little smaller than the tympanum; subarticular tubercles moderate; inner metatarsal tubercle large and very prominent, oval, about two-thirds the length of the inner toe; a fold along the inner edge of the tarsus; the tibio-tarsal articulation reaches the tympanum; tibia not half the length of the head and body; skin smooth above; lower surfaces, throat of male included, granular. Color varying from grayish or brownish to green, with darker, blackish-edged permanent symmetrical insuliform spots on the body and cross bands on the limbs; a dark brown streak from nostril to eye; lower parts whitish; lower belly and limbs carneous; sides of thighs carneous; iris dark bronzy brown. Male with an external subgular vocal sac.

From snout to vent 35 mm.[a]

Dimensions.—British Museum, No. 89.12.16.197.7; middle Ussuri; Doerries, collector.

	Male.	Female.
	mm.	*mm.*
From snout to vent	35	40
Length of head	12	13
Width of head	13	15
Diameter of the tympanum	2	3
Fore limb	20	23
Hind limb	51	57
Tibia	15	17
Inner toe	4	4
Inner metatarsal tubercle	2.5	[a]2.5

[a] Boulenger, Ann. Mag. Nat. Hist. (6), V, Feb. 1890, p. 142.

Habitat.—The only specimens until recently recorded as belonging to this form are the ones mentioned above, one from Port Hamilton, off the south end of Korea, and two from the middle Ussuri. In the Hamburg Museum there are specimens from Khabarovka (No. 863) as well as from Vladivostok (No. 864), collected by Dieckmann, which are there referred to this species. Nikolski, in 1905, refers tree-toads from as far west as Nertshinsk and the river Shilka, as well as the Yezo specimens in the St. Petersburg Museum to this species.

List of specimens of Hyla stepheni.

Brit. Mus. No.	Sex.	Locality.	When collected.	By whom collected.
89.11.8.5	(*a*)	Port Hamilton, Korea		G. Stephen.
89.12.16.197.7	Male [b]	Middle Ussuri		Doerries.
	Female [b]	do		Do.

[a] Type, description, p. 85. [b] P. 86.

HYLA CHINENSIS[b] Guenther.

Plate IX, fig. 4.

1858. *Hyla arborea* var. *chinensis* Guenther, Cat. Batr. Sal. Brit. Mus., p. 108, pl. IX, fig. C[c] (type-locality, China; types in Brit. Mus.).

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[a] Boulenger, Proc. Zool. Soc., 1887, p. 579.

[b] Signifying Chinese.

[c] Reproduced in this work on Plate IX.

1864. *Hyla chinensis* Guenther, Rept. Brit. India, p. 436 (southern China and Formosa).—Steindachner, Novara Exped., Zool., I, Amph., 1867, p. 59 (Amoy).—Camerano, Atti Accad. Sci., Torino, XIV, Pt. 5, Apr. 1879, p. 894 (China).—Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 381 (China; Formosa).—Boettger, Kat. Batr. Mus. Senckenberg., 1892, p. 43 (Dalanshan and Lueshan Mts., China); Ber. Senckenberg. Naturf. Ges., 1894, p. 141 (Lueshan Mts. near Kiukiang); p. 149 (Dalanshan and Chinhai, near Ningpo).

This species is closely allied to *Hyla arborea*, but the vomerine teeth are more posterior. The coloration is also peculiar and easily recognizable, the color above being uniform and immaculate bright green, the sides beautifully sulphur yellow (according to Boettger), white in alcohol, with round spots of a deep black, and extensive markings of the same color on the posterior aspect of the thighs.

Habitat.—This species occurs in southern and eastern China at least as far north as Shanghai, and as far west as the Tsin Ling Mountains, Shensi, whence the U. S. National Museum has specimens (Cat. nos. 19230 and 35529).

Swinhoe obtained it in Formosa and sent specimens to the British Museum, which also has a specimen from Taiwan fu, received from the Formosa Museum, and several other specimens (males, females, and young) collected by Mr. Holst in West Taiwan fu.

List of specimens of Hyla chinensis.

Museum.	No.	Age.	Locality.	When collected.	By whom collected or from whom obtained.
U.S.N.M	19230	Adult	Shanghai, China		Brit. Mus.
Do	35529	do	Shensi, China	1904	E. Blackwelder.
Brit. Mus		do	Taiwan fu, Formosa		P. Holst.

Family ENGYSTOMIDÆ.

Jaws without teeth; shoulder-girdle, firmisternian and sacral lateral processes dilated. Widely distributed over the tropical portions of the globe. Most of the forms are terrestrial, some burrow in the ground, some are aquatic, but none are arboreal. Many of the species are ant-eaters.

Only one genus is represented within the area covered by this work.

Genus MICROHYLA[a] Tschudi.

1838. *Microhyla* Tschudi, Classif. Batr., pp. 28, 71 (type, *Hylaplesia achatina*).
1841. *Micrhyla* Duméril and Bibron, Erpét. Gén., VIII, p. 613 (emendation).
1843. *Hylaplesia* Fitzinger, Syst. Rept., p. 31 (type, *H. achatina*) (not of Boie, 1827).
1843. *Siphneus* Fitzinger, Syst. Rept., p. 33 (type, *Engystoma ornatum*) (not of Brants, 1827).

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[a] From μικρος, small; and *Hyla*, the generic name of the common tree-toad.

1848. *Dendromanes* GISTEL, Naturg. Thierr., p. XI (substitute for *Microhyla*).
1858. *Diplopelma* GUENTHER, Cat. Batr. Sal. Brit. Mus., p. 50 (type, *Engystoma ornatum*).
1861. *Scaptophryne* FITZINGER, Sitz. Ber. Akad. Wiss. Wien, XLII (p. 146) (type, *S. labyrinthica=Engystoma pulchrum*).
1872. *Ranina* DAVID, Nouv. Arch. Mus. Hist. Nat. Paris, VII, fasc. 4, Bull., p. 76 (type, *R. symetrica=E. pulchrum*) (not of Lamarck, 1801).

The genus *Microhyla*, though belonging to an entirely different family, agrees with *Bufo* in having no teeth, but is easily distinguishable by the smooth skin, roundish pupil, and absence of parotoid glands.

This genus embraces at least nine species peculiar to China and various parts of the East Indies, including Ceylon and some of the islands in the Malay Archipelago, such as Sumatra, Java, and Borneo. Two forms allied to the widely distributed *Microhyla ornata*, which also occurs in China, are found within our territory, namely, one in Formosa and the other in the Riukiu Archipelago.

They may be distinguished as follows:

a^1 Toes entirely free; metatarsal tubercles rather small............*M. fissipes*, p. 88.
a^2 Toes with a distinct rudiment of web at base; metatarsal tubercles rather large. *M. okinavensis*, p. 89.

MICROHYLA FISSIPES[a] Boulenger.

1884. *Microhyla fissipes* BOULENGER, Ann. Mag. Nat. Hist. (5), XIII, p. 397 (type-locality, Taiwan fu, southern Formosa; type in British Museum).

The original description by Boulenger is reproduced herewith. For further notes see the remarks under *Microhyla okinavensis* further on (pp. 89–90).

Original description of type-specimen.—British Museum; Taiwan fu, south Formosa; R. Swinhoe, collector. Habit slender; snout truncate, slightly longer than the orbital diameter; interorbital space broader than the upper eyelid; fingers slender, first much shorter than second; toes long and slender, free, with a slight lateral fringe; tips of fingers and toes not swollen; subarticular tubercles distinct; two rather small, obtuse, metatarsal tubercles; the hind limb being carried forward along the body, the tibio-tarsal articulation reaches the eye; skin nearly smooth above, with small warts on the sides. Olive-brown above, the small warts tinged with red; a darker lateral band from the tip of the snout, passing through the eye down to the middle of the side; an elongate X-shaped darker marking commencing between the eyes, and another, V-shaped, on sacral region; limbs with dark crossbars. From snout to vent 26 mm. (Boulenger, Ann. Mag. Nat. Hist. (5), XIII, 1884, pp. 397–398.)

Habitat.—This species seems to be restricted to Formosa. There are three specimens in British Museum, viz, the type collected by

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[a] From *Fisssu*, split; *pes*, foot.

Swinhoe at Taiwan fu and two specimens secured by Holst in central Formosa. The United States National Museum has recently obtained a small specimen from "Daipe or Daihoku," north Formosa, through Mr. A. Owston.

List of specimens of Microhyla fissipes.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	34469		Daipe, north Formosa	Mar. —, 1903	A. Owston.
Brit. Mus	(*a*)		Taiwan fu		R. Swinhoe.
Do	94. 11. 14. 9		Central Formosa		P. Holst.
Do	94. 11. 14. 10		do		Do.

[a] Type; description p. 88.

MICROHYLA OKINAVENSIS[a] Stejneger.

1887. *Microhyla fissipes* BOULENGER, Proc. Zool. Soc. London, 1887, p. 150 (not of 1884) (Riu Kiu Islands).—OKADA, Cat. Vert. Jap., 1891, p. 66 (Okinawa).—FRITZE, Zool. Jahrb. Syst., VII, 1894, p. 865, author's separate, p. 16.—BOETTGER, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 106 ("Ohoshima or Okinawa").

1901. *Microhyla okinavensis* STEJNEGER, Proc. Biol. Soc. Washington, XIV, 1901, Dec. 12, p. 189 (type-locality, Okinawa shima; type, Sci. Coll. Mus. No. 25*a* = U.S.N.M. No. 36553).

1902. *Microhyla undulata* BROWN, Proc. Phila. Acad., 1902, June 11, p. 186 (type-locality, "Loo Choo Islands;" types, Wistar Instit. Phila., Nos. 5726–8; Furness and Hiller, collectors).

I was so fortunate as to be able to compare five specimens of the present species with the type and three other Formosan specimens of *M. fissipes* in British Museum. The former consisted of two specimens brought by Pryer's collector from the Riu Kius (Brit. Mus. 87.1. 31. 43–44), and three collected by Holst in the mountain regions of Motobu, about 30 miles north of Nafa, Okinawa shima (Brit. Mus. 92. 9. 3. 24–26). The chief difference between the Formosan specimens and those from Riu Kiu consists in the presence of a distinct, though small, basal web between the toes and in the appreciably greater development of the metatarsal tubercles in the latter. Other differences which I thought that I had detected between my type-specimen and the original description of *M. fissipes* did not hold. Thus, the smoothness of the sides or presence of slight warts does not seem to be of any moment, and the coloration is essentially alike. The X and V shaped marks of the type, as described by Boulenger, are only due to the somewhat darker outlining anteriorly and posteriorly of the median dorsal patch; the median white dorsal stripe of the type of *M. okinavensis* is only shown by one of Pryer's specimens.

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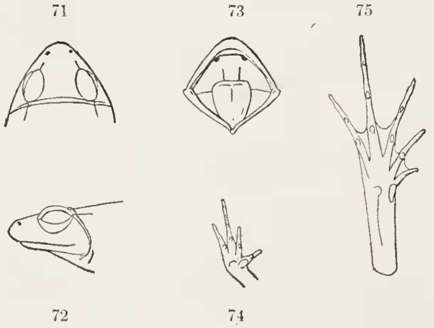
[a] From Okinawa shima.

How unreliable a character is furnished by the comparative length of the hind legs is shown by Holst's Riukiu specimens. In the smallest of these the tibio-tarsal joint just reaches the snout; in the medium-sized specimens it goes considerably beyond the snout, and in the largest one only to the front of the eye.

The United States National Museum has now a large series from Ishigakishima, the first record from this group. They agree distinctly with the Okinawa type and not with the Formosa specimen, which we also now possess.

Brown's *Microhyla undulata* is the same as the present species and is published six months later. It is stated in the original description that the toes are "half-webbed," but that is a mistake, as an examination of the types in the Wistar Institute in Philadelphia showed me. The web in these specimens, as in the others, is between the metatarsals, while only a small portion of it extends beyond the base of the toes.

Description of type.—Adult female; U.S.N.M. No. 36553. Okinawa shima; Sci. Coll. Mus. Tokyo No. 25*a* (figs. 71–75).—Snout rather pointed, slightly longer than diameter of orbit; interorbital space broader than upper eyelid; first finger much shorter than second; toes with a distinct though slight web at base and a mere indication of a fringe along the toes; tips of fingers and toes not widened; subarticular tubercles very distinct; metatarsal tubercles rather large, the inner measuring more than one-half the orbital diameter; the hind limb being carried forward along the body, the tibio-tarsal joint barely reaches the eye; skin smooth above and on sides. Color (in alcohol) of a purplish gray above, with a light, very narrow median line from tip of snout to above anus; a spear-shaped dark brownish mark on occiput, from between the eyes, with the tip pointing backward and widening into two wavy dark bands which diverge toward the groins, contracting again on the sacrum, ending on the upper side of the thighs and embracing a space on the back somewhat darker than the ground color; outside of these bands and parallel with them are several faint, wavy lines of a dusky color; a dark brownish band of considerable width starts at the tip of the snout, covering the sides of face and neck, runs backward above the arm, is lost on the groin but reappears on the anterior aspect of the thigh;



Figs. 71–75.—Microhyla okinavensis. 1½ × nat. size. 71, top of head; 72, side of head; 73, open mouth; 74, underside of hand; 75, underside of foot. No. 36553, U.S.N.M.

the opposite edges of the dorsal and lateral dark bands are very sharply defined and emphasized by a very narrow light line; a dark band on the posterior aspect of the thighs, joining in an arch over the arms; a pale band from eye to the insertion of the fore leg; limbs with dark crossbars; underside whitish, heavily marbled with dark brownish gray on chin and throat, less so on anterior and lateral parts of belly; only a small portion of the latter posteriorly is immaculate.

Dimensions.

	mm.
Total length from snout to vent	28
Greatest width of body	20
Width of head at posterior angle of eye	8
Fore limb	13
Hind limb	43
Tibia	14

The *adult male* is somewhat smaller than the female, with slightly longer hind legs; throat distinctly blackish.

Variation.—The pale line down the middle of the back is often lacking and the faint wavy lines between the broad, heavy dorsal and lateral bands are often very faint or absent.

Habitat.—This species inhabits the islands between Japan and Formosa, from Okinawa shima southward, as shown by numerous specimens collected in the latter island and Ishigaki shima, of the Yaeyama subgroup.

Whether the species also occur on Miyako shima is not known.

List of specimens of Microhyla okinavensis.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	23906		Kunshiau, Okinawa shima.		I. Ijima.
Do	34472	Female	Ishigaki shima	April-June, 1899.	A. Owston.
Do	34473	do	do	do	Do.
Do	34474	do	do	do	Do.
Do	34475	do	do	do	Do.
Do	34476	do	do	do	Do.
Do	34477	do	do	do	Do.
Do	34478	do	do	do	Do.
Do	34479		do	do	Do.
Do	34480		do	do	Do.
Do	34481	Male	do	do	Do.
Do	34482		do	do	Do.
Do	34483		do	do	Do.
Do	34484	Male	do	do	Do.
Do	34485		do	do	Do.
Do	34486	Male	do	do	Do.
Do	34487	Female	do	do	Do.
Do	34488		do	do	Do.

List of specimens of Microhyla okinavensis—Continued.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M.	34489		Ishigaki shima	April-June, 1899.	A. Owston.
Do.	34490		do	do	Do.
Do.	34491	Male	do	do	Do.
Do.	36553	Female [a]	Okinawa shima		Sci. Coll.
Sci. Coll. Tokyo	(1) P. 3		Shuri, Okinawa shima		Shiraishi.
Brit. Mus.	87.1.31.43		Riu Kiu		J. S. Pryer.
	87.1.31.44		do		Do.
Do.	92.9.3.24		Motobu, Okinawa shima		P. Holst.
Do.	92.9.3.25		do		Do.
Do.	92.9.3.26		do		Do.
Wistar Inst.	5726	(b)	Riu Kiu		Furness and Hiller.
	5727	(b)	do		Do.
	5728	(b)	do		Do.

[a] Type; description, p. 90; figs. 71-75.

[b] Types of *M. undulata*.

Family RANIDÆ.

The frogs proper are characterized by teeth in the upper jaw combined with a firmisternian shoulder-girdle.

They constitute the largest family of the tailless batrachians, embracing considerably over one-fourth of all the species, and are distributed over nearly all the temperate and tropical regions of the globe, except Australia, New Zealand, eastern Polynesia, and Hawaii. Most of the species are more or less aquatic in their habits, but many are arboreal; some are terrestrial, and a few burrow in the ground. Several of the larger species are used for food in various countries and are considered great delicacies. Like all the other batrachians they are highly useful in destroying injurious insects.

Many of the frogs belonging to this family, especially those with large digital disks, resemble the tree-toads to a high degree; so much so in fact that until a comparative recent date they were referred to the latter, from which they differ radically, however, in their osteological characters. Nevertheless, there is an "external" character—i. e., one that can be ascertained without dissection—which will enable us to properly place them, viz, the lateral or median prolongation of the posterior free edge of the tongue so as to form two lateral "horns" with a deep median incision, or a single median "horn," as in the genus *Oxyglossus*. All the species known to occur within our territory are provided with two lateral posterior horns on the tongue.

Two genera only are represented in Japan and adjacent territory.

KEY TO THE GENERA OF JAPANESE FROGS.

a^1 Distal and penultimate phalanges of digits continuous, without any kink separating them, there being no bone intercalated between them;[a] (species occurring in Japan proper have tips of digits simple, without regular disks)........*Rana*, p. 95

a^2 A well-defined kink, or transverse notch, on upper surface of digits between the distal and penultimate phalanges, due to an intercalated small bone;[a] (tips of digits with large disks)......................................*Polypedates*, p. 143

Genus RANA[b] Linnæus.

1758. *Rana* LINNÆUS, Syst. Nat., 10 ed., I, p. 210 (type, *R. temporaria*); 12 ed., 1766, I, p. 354.

1814. *Ranaria* RAFINESQUE, Specchio Sci. (Palermo), II, fasc. 7 (substitute name for *Rana*).

1843. *Pelophylax* FITZINGER, Syst. Rept., p. 31 (type, *Rana esculenta*).

1891. *Crotaphitis* SCHULZE, Jahresber. Naturw. Ver. Magdeburg, 1890, p. 176 (type, *Rana temporaria*).

1891. *Baliopygus* SCHULZE, Jahresber. Naturw. Ver. Magdeburg, 1890, p. 177 (type, *Rana esculenta*).

Only such synonyms are here enumerated as refer directly to Japanese species or are additional to those quoted in recent synonymies.

The numerous species may be identified by the following:

SYNOPSIS OF THE SPECIES OF RANA RECORDED FROM JAPAN AND ADJACENT TERRITORY.

a^1 A distinct dorso-lateral fold.
  b^1 Heels not overlapping.
    c^1 Vomerine teeth between choanæ.
      d^1 Dorso-lateral fold narrower than interorbital space; numerous distinct longitudinal ridges between folds.........................*R. nigromaculata*, p. 94
      d^2 Dorso-lateral fold as broad as interorbital space; no longitudinal glandular ridges between dorso-lateral folds.........................*R. plancyi*, p. 101
    c^2 Vomerine teeth behind choanæ.........................*R. okinavana*, p. 102
  b^2 Heels overlapping.
    c^1 Tips of digits without regular disks.
      d^1 Hind legs twice as long as head and body.................*R. longicrus*, p. 104
      d^2 Hind legs much less than twice as long as head and body.
        e^1 A very prominent knob, rudiment of pollex, on inner side of first finger. *R. holsti*, p. 105
        e^2 No prominent knob (not to be confounded with copulary excrescences) on inner side of first finger.
          f^1 Snout long, pointed, distance from orbit to tip of snout longer than width between black stripes at anterior border of orbit.....*R. japonica*, p. 107
          f^2 Snout short, blunt; distance from orbit to tip of snout not longer than width between black stripes at anterior border of orbit.
            g^1 Vomerine teeth between choanæ, only their posterior end projecting backwards beyond them; webs large..........*R. temporaria*, p. 113
            g^2 Vomerine teeth behind level of choanæ, or nearly so; webs between toes small.
              h^1 Inner metatarsal tubercle rather large.......*R. tsushimensis*, p. 116
              h^2 Inner metatarsal tubercle small...............*R. amurensis*, p. 119
    c^2 Tips of digits dilated into distinct disks.....................*R. ijimæ*, p. 121

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[a] It is well not to rely upon the "kink," but to ascertain the presence or absence of the intercalated phalanx by dissection.

[b] Latin name for frog.

a^2 No dorso-lateral fold.
  b^1 No tooth-like protuberance in lower jaw.
    c^1 Distance of nostril from eye much less than twice that from edge of lip.
      d^1 Tips of digits not dilated into disks.
        e^1 Width of head two and a half times in length of head and body; heels scarcely overlapping; forehead concave; two terminal joints of fourth toe free .... *R. rugosa*, p. 123
        e^2 Width of head about three times in length of head and body; heels overlapping considerably; forehead not concave; three terminal joints of fourth toe free.................................... *R. limnocharis*, p. 127
      d^2 Tips of fingers dilated into distinct disks.
        e^1 Skin above smooth .... *R. swinhoana*, p. 132
        e^2 Skin above very rough, with warts in circular clusters of smaller surrounding larger ones.................................. *R. ishikawæ*, p. 132
    c^2 Distance of nostril from eye twice that from edge of lip....... *R. narina*, p. 134
  b^2 Two large tooth-like protuberances in lower jaw.
    c^1 Interorbital width much greater than width of upper eyelid.. *R. namiyei*, p. 136
    c^2 Interorbital width less than upper eyelid.................. *R. tigerina*, p. 139

RANA NIGROMACULATA[a] Hallowell.

Plate X, fig. 1.

1765. ?*Rana chinensis* OSBECK, Reise Ostind. China, I (p. 244); Voy. China (Engl. ed.), I, 1771, p. 299 (Canton, China).

1838. *Rana esculenta* SCHLEGEL, Fauna Japon., Rept., pp. 109, 139, Saur. et Batr., pl. III, fig. 1[b] (Japan) (not of Linnæus).—MARTENS, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 111 (Yokohama); 1876, p. 384 (Yokohama and Nagasaki).—HILGENDORF, Sitz. Ber. Berlin. Naturf. Fr., 1880, p. 119 (Tokyo).—FRITZE, Mitt. Deutsch. Ges. Ost-Asiens, V, 1891, p. 239 (Yezo).—NIKOLSKI, Zap. Imp. Akad. Nauk, S. Peterburg, (8), XVII, No. 1, 1905, p. 337 (part: Tokyo, Amurland, etc.).

1858. *Rana viridis* BLEEKER, Natuurk. Tijdschr. Nederland. Indië, XVI, p. 204 (Japan) (not of Linnæus).

1859. *Rana esculenta* var. *japonica* MAACK, Putesh. na Amur (p. 153) (not *R. temporaria* var. *japonica* GUENTHER, 1858).—BOULENGER, Cat. Batr. Sal. Brit. Mus., 1882, p. 40 (Japan; Chefu; Chusan; Shanghai; Ningpo).—GIGLIOLI and SALVADORI, Proc. Zool. Soc. London, 1887, p. 595 (Fusan, Korea).—BOETTGER, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 93 (Peking; Shanghai).—OKADA, Cat. Vert. Japan, 1891, p. 67 (Suwo; Yamaguchi; Tokyo; Mino; Gifu; Awaji).

1860. *Rana marmorata* HALLOWELL, Proc. Phila. Acad., 1860, p. 500 (type-locality, Simoda, Japan; type, U.S.N.M. No. 12159; Dr. Morrow, collector) (not of Massalongo, 1854).—CAMERANO, Atti Accad. Sci. Torino, XIV, Pt. 5, Apr., 1879, p. 871 (Tokyo; Yokohama).—FOX, Science (n. s.), XII, Nov. 9, 1900, p. 717.

1860. *Rana nigromaculata* HALLOWELL, Proc. Phila. Acad., 1860, p. 500 (type-locality, Japan; Dr. Morrow, collector).

1860. *Rana rugosa* HALLOWELL, Proc. Phila. Acad., 1860, p. 499 (part only: specimens from Simoda) (not of Schlegel).

1867. *Hoplobatrachus reinhardtii* PETERS, Mon. Ber. Berlin Akad. Wiss., 1867, p. 711 (type-locality, Malacca or China).—*Rana reinhardti* MOELLENDORFF, Journ. N. China, Br. R. Asiat. Soc. (n. s.), XI, 1877, p. 105 (Peking).

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[a] From the Latin, signifying black-spotted.

[b] Reproduced in this work on Plate X, fig. 1.

1868. *Tomopterna porosa* Cope, Proc. Phila. Acad., 1868, p. 139 (type-locality, Kanagawa; type in Mus. Comp. Zool. Cambr. No. 305; Dr. Gulick, collector).—*Rana porosa* Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 40.

1880. *Rana esculenta marmorata* Lataste, Bull. Soc. Zool. France, V, 1880, p. 61 (Peking); Le Natural., 1880 (p. 210) (not of Massalongo, 1854).

1891. *Rana esculenta* var. *nigromaculata* Boulenger, Proc. Zool. Soc. London, 1891, pp. 376, 377, 383. (Yokohama; Hakone Lake; Okinawa shima, Riu Kiu).—Boettger, Kat. Batr. Mus. Senckenberg, 1892, p. 6 (China and Japan).—Bedriaga, Przewalski Reise, Zool., III, Pt. 1, 1899 (p. 11).—Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II, Klasse, Pt. 2, 1904, p. 358 (Shanghai and Hankow, China).

1897. *Rana esculenta* var. *chinensis* Boulenger, Tailless Batr. Eur., II, p. 272; fig. *D*, p. 273 (Korea and Japan to southern China and Siam).—Méhely, Zichy's Dritte Asiat. Forschungsr., II, 1901, p. 62 (Peking).

1899. *Rana chinensis* Stone, Proc. Phila. Acad., 1899, p. 183 (Khingan mountains and Lama-mio, eastern Mongolia).

In an article on "The names of animals, published by Osbeck in 1765,"[a] Mr. W. J. Fox states that Osbeck's *Rana chinensis* is "without doubt a *Bufo*," and that "Boulenger has erred in referring it to *Rana*, as Osbeck says in his description, 'the body above warty,' which sufficiently indicates that the species is not a *Rana*." Now, if Mr. Fox had known *R. tigerina* and *R. rugosa*, he would not have said this, since they are a great deal more warty than many a *Bufo*. There are points in Osbeck's description which show that the animal was "without doubt" a *Rana* and that Boulenger did not err in so referring it.

Whether Boulenger was right, however, in referring *Rana chinensis* Osbeck to the eastern representative of *R. esculenta* is another question, and as I have grave doubts as to the correctness of this view I prefer to leave the name with a ? as unidentifiable. The expression "the body is warty at the top" (to use the English translation of 1771) might be applied to the frog in question, but it applies much better to *Rana tigerina*, which is also sold in the markets of Hongkong and Canton. With this agrees also the character: "The throat is white, speckled with black." On the other hand, Osbeck's allusion to the "sixth or innermost" finger seems to fit better the larger metatarsal tubercle of *R. nigromaculata*. As the name can not therefore be applied with absolute certainty to either of these species I think it is better to dispense with it altogether.

Mr. Fox's plea for *Rana marmorata* Hallowell, 1860, as the proper name for the eastern frog can not be entertained either, as that name was disposed of by Massalongo six years earlier[b] for one of the European forms of *Rana esculenta*.

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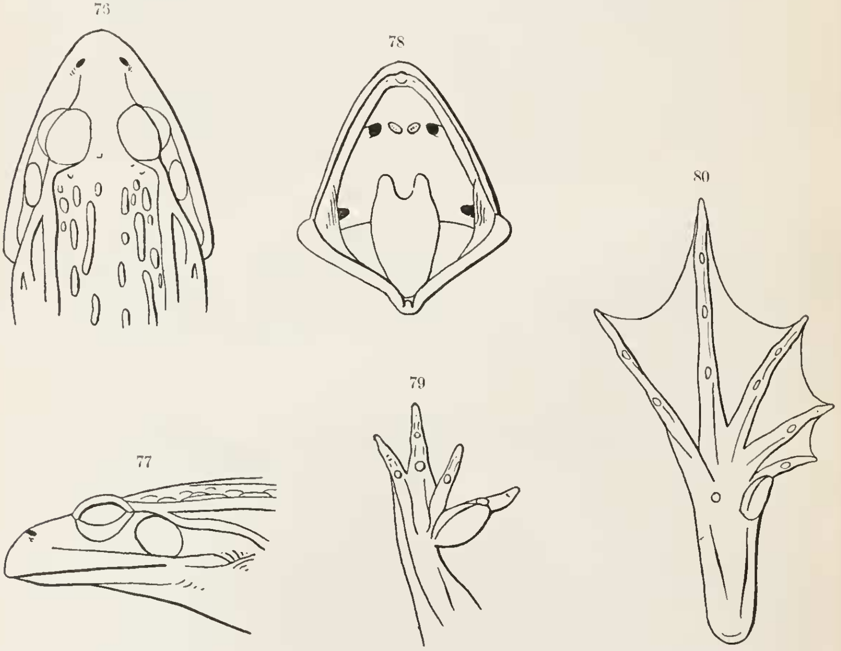
[a] Science (n. s.), XII, Nov. 9, 1900, pp. 716–718.

[b] *Rana esculenta* var. *marmorata* Massalongo, Saggio di un' erpetol. popol. Verones., 1854 (p. 47).

There seems to be no good reason for applying a trinominal to this eastern representative of *Rana esculenta*. The character of the numerous short dermal ridges on the back between the dorso-lateral folds seems absolutely diagnostic. Moreover, in proportions it differs more from its nearest neighbor, *Rana ridibunda*, than from the more remote forms of *R. esculenta* inasmuch as the heels do not overlap. Finally, it has not been shown as yet that the range of our species meets that of any of the western forms.

The types of *R. nigromaculata* of Hallowell (collected by Doctor Morrow) are not in the National Museum, but the description fits our species fairly well. The types of his *R. marmorata*, however, are still in good state of preservation (U.S.N.M. No. 12159), being apparently two females very much like the specimen figured by Schlegel (*l. c.*) as *R. esculenta.*[a] Hallowell's measurements were apparently taken (in a rather careless manner) from the smaller specimen. It is worthy of note that Hallowell referred several other specimens, males with large vocal vesicles (U.S.N.M. No. 7415, figs. 76–80), to *Rana rugosa*, thus enumerating the specimens of the same species, and practically from the same locality, under three different specific names.



Figs. 76–80.—Rana nigromaculata. Nat. size. 76, head from above; 77, head from side; 78, open mouth; 79, underside of hand; 80, underside of foot. No. 7415, U.S.N.M.

A young specimen in the collection of the Philadelphia Academy of Sciences (No. 15256) collected by Dr. W. H. Jones, at Chemulpo,

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[a] Plate IX, fig. 1 of this work.

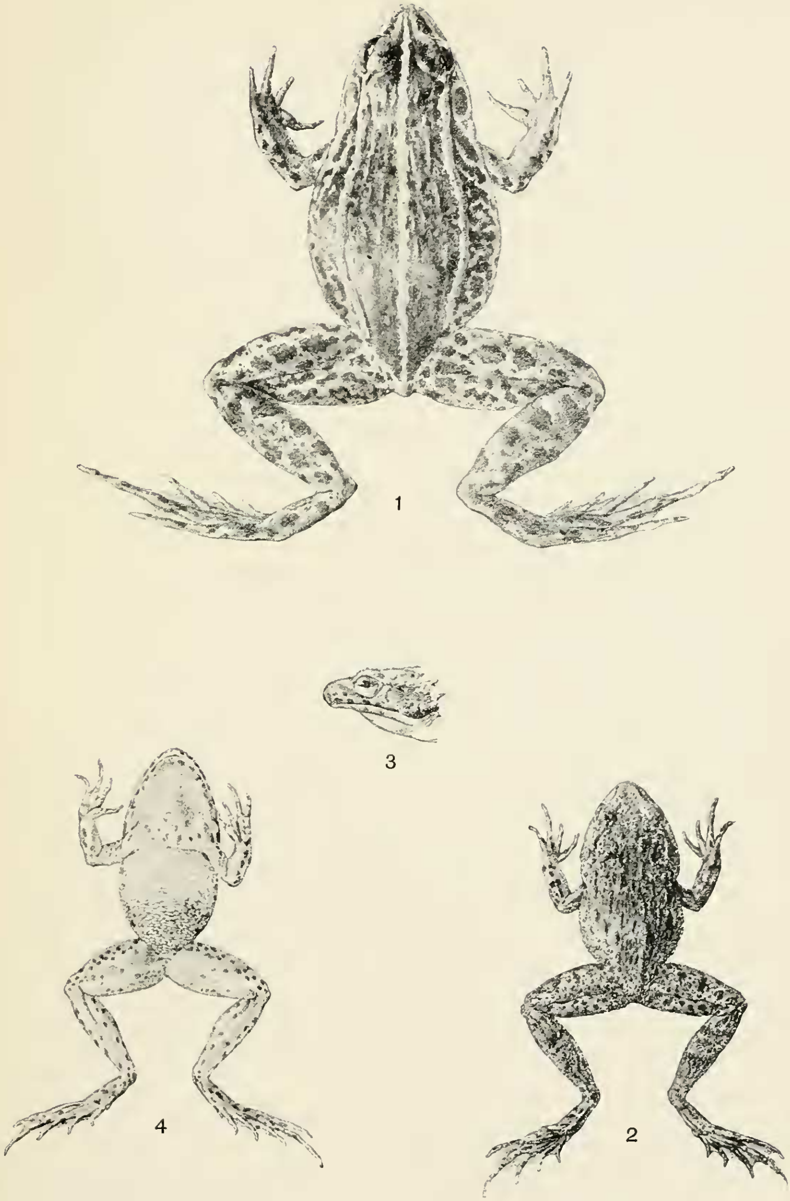

FIG. 1, RANA NIGROMACULATA; FIGS. 2-4, R. RUGOSA. (FROM SCHLEGEL.)

FOR EXPLANATION OF PLATE SEE PAGE 554.

Korea, August, 1890, is almost without spots on the back and has an oblique black line behind the tympanum suggesting the ear spot of *R. japonica.* Such a specimen is superficially much like the latter species, but the much shorter tarsus and femur, the much larger inner metatarsal tubercle, and the longitudinal dermal ridges on the back between the dorso-lateral ridges at once indicate *R. nigromaculata.*

Description.—Adult male; U.S.N.M. No. 23579; Yokohama; September, 1896; L. Stejneger, collector. Vomerine teeth in two slightly oblique groups between the choanæ, their posterior end extending somewhat behind the latter; nostrils somewhat nearer the eye than the tip of the snout; distance between nostrils equals their distance from orbits; interorbital space narrow, scarcely more than half the width of upper eyelid; tympanum slightly longer than high, its longest diameter four-fifths that of the eye, and more than twice its distance from the latter; first finger considerably longer than second, its basal phalanx and the metacarpal on the inner side provided with a large swollen pad very minutely granulated; tips of digits tapering, obtusely pointed, the terminal phalanx being set off from the rest of the digit by a fold across the joint which is markedly more distinct than on the other joints; toes about three-fourths webbed, the deepest incision of the webs on both sides of fourth toe scarcely reaching the end of its basal phalanx; subarticular tubercles small but distinct; inner metatarsal tubercle large, projecting, sharp, its length nearly four-fifths the length of the first toe from the anterior end of the tubercle a distinct outer metatarsal tubercle; no tarsal fold; hind limb being carried forward along the side of the body the tibio-tarsal joint reaches the anterior border of the eye; heels do not meet when hind limbs are bent at right angles to axis of body; a strongly marked dorso-lateral fold from posterior border of eye to insertion of hind limb; between these folds about four series of somewhat irregular but sharply marked longitudinal dorsal folds, the longest about as long as upper eyelid; skin above indistinctly shagreened, more coarsely granular on the sides and on the posterior aspect of the femur, transversely rugose on the belly, nearly smooth on chest and throat; a large external vocal sac on each side below the angle of the mouth. Color (in alcohol) above brownish olive with longitudinal blackish spots, one surrounding each dorsal glandular fold; dorso-lateral folds paler brownish; a narrow pale bluish line from the snout down the median line of the back; sides with irregular blackish spots which encroach upon the lower edge of the dorso-lateral fold; upper surface of limbs with dusky spots which form crossbars on femur; upper lip with a few small dusky spots; underside uniform whitish.

Dimensions.

	mm.
Total length, tip of snout to vent	60
Width of head	22
Length of fore leg	34
Length of hind leg, tip of longest toe to vent	92
Length of tibia	25
Diameter of tympanum	5
Length of inner metatarsal tubercle	5

The *adult female* (U.S.N.M. No. 23576) lacks the vocal sacs and the swollen pad at the base of the first finger, but agrees in other respects closely with the description of the male given above.

Variation.—My September specimens from Yokohama are all essentially like the ones described above. The specimens collected by Doctor Smith in Shikoku on May 11, as well as Owston's from Mount Fuji, also collected in May, differ chiefly in coloration, the black pigment being much more concentrated, the pale areas consequently lighter, and the whole appearance brighter and with greater contrasts. Thus the pale median dorsal line is greatly widened and the ground color between it and the dorso-lateral folds so darkened as to entirely obscure the dorsal spots; a black line runs from tip of snout through nostril and eye bending down sharply behind the tympanum; the dark blotches on the hind legs form distinct and strongly contrasted cross-bars. With the elongation of the blackish coloration on the back there is associated a distinct lengthening of the dorsal glandular folds so that they run together into long irregular ridges. Jouy's specimens from near Seoul, which were taken in June, are very much like the ones from Shikoku, and so are Hallowell's types of *R. marmorata*. The difference is evidently seasonal.

Habitat.—Widely distributed in eastern Asia from Vladivostok (Hamburg Mus., No. 871, collected by Dieckmann) in the North to Bangkok, Siam (Brit. Mus.), in the South. Maack collected it on the Amur and Ussuri rivers and Radde in the Khingan Mountains. It is recorded from numerous localities in China, such as Peking (Moellendorff and Lataste); Shanghai, Kiukiang, Chapu, Hankow (Boettger); Chefu, Chusan, Ningpo (Boulenger); Ordos (Przewalski). There are specimens in British Museum from Broughton Bay and Gensan, Korea; in the Philadelphia Academy from Chemulpo (No. 15256), and others in the U. S. National Museum from Seoul and Fusan. Stone records it from the Khingan Mountains and Lama-mio in eastern Mongolia.

On the map in Boulenger's Tailless Batrachia of Europe (at p. 263), showing the distribution of the *Rana esculenta* group, the present species is also indicated as inhabiting Formosa, though I am unable to state upon what evidence this is done.

In Japan proper *R. nigromaculata* is recorded from the provinces of Suwo and Mino and on the island of Awaji (Okada); from Nagasaki and Yokohama (von Martens); Tokyo (Okada and Hilgendorf); Miyazaki on Kiusiu, Sumiyoshi, near Osaka, Koriyama Province, Yamato, Yokohama and Simoda in Hondo (U.S.N.M.); Hakone Lake (Brit. Mus.). The United States National Museum also has specimens collected in Shikoku by Dr. H. M. Smith. Buerger's and von Siebold's numerous specimens in the Leiden Museum (Nos. 1946–1947) are only labeled "Japon." The museum in Stockholm has specimens brought home by the Vega Expedition from Biwa, Yokohama, and Hirosami.

The only record of its occurrence in Yezo is by Doctor Fritze, who states that it is "common in every pond." I am not aware that authentic specimens were identified, and the statement needs corroboration.

There is a specimen (male) in British Museum, received from G. E. Mason, said to be from "Great Loo Choo Island," but this locality is also open to question. Whether the specimens from Oo-shima (Amami-o-shima) recorded by Hallowell as *R. rugosa* really belong to this species must remain unsettled until that island can be thoroughly explored.

List of specimens of Rana nigromaculata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	a 7415	Male[a]	Simoda, Hondo	May, 1855	W. Stimpson.
Do	b 7416	Male	do	do	Do.
Do	a 8852	Female	Japan		?
Do	b 8852	Halfgrown	do		?
Do	c 8852	do	do		?
Do	a 12159	Female[b]	Simoda, Hondo		Doctor Morrow.
Do	b 12159	do	do		Do.
Do	22188		Japan		?
Do	22189		do		?
Do	23576	Female[c]	Yokohama, Hondo	Sept., 1896	L. Stejneger.
Do	23577	do	do	do	Do.
Do	23578	do	do	do	Do.
Do	23579	Male[d]	do	do	Do.
Do	23580	Female	do	do	Do.
Do	23581	do	do	do	Do.
Do	23582	do	do	do	Do.
Do	23583	do	do	do	Do.
Do	23584	do	do	do	Do.
Do	23585	do	do	do	Do.
Do	23586	do	do	do	Do.
Do	26045	Halfgrown	do	do	Do.
Do	30739	Male	Miyazaki, Kiusiu		C. A. Clark.
Do	31799	do	Sumiyoshi, near Osaka	Apr. 11, 1903	H. M. Smith.
Do	31800	do	do	do	Do.
Do	31808	Young	Koriyama, Yamato		Do.
Do	31815	Halfgrown	do	Apr. 26, 1903	Do.
Do	31816	do	do	do	Do.

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[a] Figs. 76–80; recorded by Hallowell as *R. rugosa*.

[b] Types of *R. marmorata*.

[c] Description, p. 98.

[d] Specimen described, p. 97.

List of specimens of Rana nigromaculata—Continued.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	31902	Female	Kochi, Shikoku	May 11, 1903	H. M. Smith.
Do	31903	Male	do	do	Do.
Do	31927	Halfgrown	do	do	Do.
Do	31928	do	do	do	Do.
Do	31933	Female	do	do	Do.
Do	31934	do	do	do	Do.
Do	31935	Male	do	do	Do.
Do	31936	Female	do	do	Do.
Do	31937	do	do	do	Do.
Do	31938	do	do	do	Do.
Do	31939	Halfgrown	do	do	Do.
Do	31940	do	do	do	Do.
Do	31941	Male	do	do	Do.
Do	34413	Halfgrown	Mount Fuji, Hondo	May, 1898	A. Owston.
Do	34414	do	do	do	Do.
Do	34415	do	do	do	Do.
Do	34416	do	do	do	Do.
Do	34417	do	do	do	Do.
Do	34418	do	do	do	Do.
Do	34419	do	do	do	Do.
Do	34420	do	do	do	Do.
Do	34421	Young	do	do	Do.
Do	34422	Halfgrown	do	do	Do.
Do	34423	do	do	do	Do.
Do	34424	Young	do	do	Do.
Do	34425	Halfgrown	do	do	Do.
Do	34426	do	do	do	Do.
Do	34427	do	do	do	Do.
Do	34428	Young	do	do	Do.
Do	34429	do	do	do	Do.
Do	34430	do	do	do	Do.
Do	34431	do	do	do	Do.
Do	34432	do	do	do	Do.
Do	34468	Halfgrown	Yokohama, Hondo	Apr. 2, 1901	Do.
Phila. Acad	14421	(a)	Simoda, Hondo	1855	Dr. Morrow.
U.S.N.M	17512	Young	Fusan, Korea	1885	P. L. Jouy.
Do	21195	Female	Seoul, Korea	May, 1883	Do.
Do	21196	do	do	do	Do.
Do	21197	do	do	do	Do.
Do	21198	do	do	do	Do.
Do	21199	do	do	1883	Do.
Do	21200	do	do	do	Do.
Do	21201	do	do	do	Do.
Do	21202	Halfgrown	do	do	Do.
Do	21203	do	do	do	Do.
Do	21204	do	do	do	Do.
Do	21205	do	do	do	Do.
Do	21206–10	do	do	do	Do.
Phila. Acad	15256		Chemulpo, Korea	Aug., 1890	W. H Jones.
Hamburg	871		Vladivostok	1894	Dieckmann.

[a] Cotype of *R. marmorata*.

RANA PLANCYI[a] Lataste.

1880. *Rana plancyi* Lataste, Bull. Soc. Zool. France, V, 1880, p. 64 (type-locality, Peking, China); Le Naturaliste, 1880 (p. 210).—Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 37 (Shanghai; Chusan; Ningpo; Formosa).

Description.—British Museum (one of Nos. 84. 3. 11. 1–5); Taiwan fu, Formosa; presented by Formosa Museum. Vomerine teeth in two slightly oblique groups, their posterior edge barely extending beyond the hinder edge of the choanæ; snout rather long, the distance from the tip to eye longer than that from the latter point to tympanum; lores concave; tympanum nearly as large as the eye; interorbital space narrower than upper eyelid; first finger extending slightly beyond second; toes fully webbed; inner metatarsal tubercle rather large and strong; hind leg being carried forward the tibiotarsal joint reaches the anterior corner of the eye; heels not overlapping; dorso-lateral glandular fold prominent, scarcely as wide as the interorbital space; no longitudinal glandular ridges between the dorso-lateral folds. Color (in alcohol): Upper parts with indistinct blackish spots; underside distinctly mottled with dusky, especially on throat, chest, and thighs; marblings on posterior aspect of thigh confluent into an ill-defined band; a fairly distinct dusky band from axilla to groin.

Dimensions.	*mm.*
Snout to vent	44
Snout to posterior edge of tympanum	18
Width of head	16
Diameter of eye	5.5
Width of upper eyelid	4
Interorbital width	2.5
Snout to eye	8
Diameter of tympanum	5
Fore leg	25
Tibia	20.5
Width of dorso-lateral fold	1.75

Variation.—Formosa specimens in British Museum do not have the dorso-lateral fold as broad as specimens from Shanghai (Brit. Mus.), in which it is fully as broad as the eyelid, while in the Formosan ones it barely reaches the width of the interorbital space; yet it is considerably wider than in *R. nigromaculata.* There are no distinct glandular ridges between the folds. The vomerine teeth are between the choanæ, fully as far forward as in *R. nigromaculata,* while in the Shanhai specimens their position is somewhat more posterior. Boulenger[b] says, "Seldom a light vertebral line," but of the 5 specimens from Taiwan fu, since received, 4 have a very distinct broad whitish line down the middle of the back. Inner metatarsal tubercle variable; in most specimens it is strong and large, while in a female from Formosa (by Dickinson) it is comparatively small.

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[a] For Mr. V. Collin de Plancy, attaché at the French legation in Peking, who collected the types. He is author of a Catalogue des Reptiles et Batraciens du Département de l'Aube et Étude sur la Distribution Géographique des Reptiles et Batraciens de l'est de la France, 1877, and other herpetological papers.

[b] Cat. Batr. Sal. Brit. Mus., p. 37.

Habitat.—Plancy's frog was originally described from Peking, and specimens from Shanghai, Chusan, and Ningpo are in British Museum.

The specimens recorded from Formosa are all in British Museum, the only ones with a definite locality being from Taiwan fu.

List of specimens of Rana plancyi.

Museum.	Number.	Sex.	Locality.	When collected.	By whom collected.
Brit. Mus.	65. 10. 29. 37		Formosa		R. Swinhoe.
Do	65. 10. 29. 38		do		Do.
Do	79. 6. 4. 25	Female	do		Dickinson.
Do	84. 3. 11. 1		Taiwan fu, Formosa		Formosa Mus.
Do	84. 3. 11. 2		do		Do.
Do	84. 3. 11. 3		do		Do.
Do	84. 3. 11. 4		do		Do.
Do	84. 3. 11. 5		do		Do.

RANA OKINAVANA[a] Boettger.

1895. *Rana okinavana* Boettger, Zool. Anz., XVIII, July 8, 1895, p. 266 (type-locality, Okinawa shima, Riu Kiu; types, Mus. Senckenberg. No. 1072, 1*a*); Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 103.

This species is not represented in any of the collections which have reached the U. S. National Museum or the Science College Museum in Tokyo. I owe the inspection of the two type specimens in the Senckenberg Museum in Frankfort on the Main to the kindness of Doctor Boettger, whose original description I give below in translation. I have only to add that the heels do not overlap. A third specimen also from the late Mr. B. Schmacker, whose Japanese collector obtained them in the Riu Kius, is in the Bremen Museum according to Doctor Boettger.

Original description by Doctor Boettger.—Adult female; Senckenberg Museum, No. 1072; Okinawa shima. In general similar to *R. lateralis* Boulenger, but with shorter snout and more robust; vomerine teeth in two rounded bundles beginning on a line with the posterior border of the choanæ and separated from them as well as from each other by equal intervals; head moderately large; snout short, anteriorly slightly pointed, and somewhat produced, as long as the diameter of the eye; nostrils equidistant from tip of snout and eye; canthus rostralis angular, loreal region slightly depressed longitudinally; interorbital space scarcely broader than the upper eyelid; tympanum very distinct, three-fourths the size of the eye; fingers moderately

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[a] From Okinawa shima.

IX. PRELIMINARY DESCRIPTIONS OF NEW SPECIES AND VARIETIES OF CRUSTACEA STOMATOPODA IN THE INDIAN MUSEUM.

By STANLEY KEMP, *B.A., Assistant Superintendent, Indian Museum.*

The following short descriptions of twelve new forms are preliminary in nature and will be succeeded, at no distant date it is hoped, by a full illustrated account.

The late Mr. J Wood-Mason took a special interest in this group and would doubtless have published an extensive memoir on them, had he lived. To a considerable number of the new forms he had assigned manuscript names and from the notes and figures which he had made Col. Alcock, in 1895,[1] was able to edit an account of nine species Other forms were also recognized under manuscript names, but from the rough notes which were available it was found impossible to draft adequate specific descriptions.

Wherever possible I have retained the names adopted by Wood-Mason and, thanks to the considerable additions which have since been made to the collection, I have also to introduce a number of other new species, most of which have been obtained by the R.I.M.S.S. 'Investigator.'

Gonodactylus (Protosquilla) nefandus, sp. nov.

This species is allied to *Gonodactylus trispinosus*, Dana, *G. pulchellus*,[2] Miers, and *G. tuberosus*, Pocock. Its closest affinities are with *G. pulchellus* and along with that species it may be distinguished from *G. trispinosus* and *tuberosus* by the smooth and unsculptured median portion of the fifth abdominal somite.

Several examples of *G. pulchellus* from Ceylon (the type locality) are preserved in the Indian Museum and, compared with these, *G. nefandus* shows the following distinctive features:—

The antero-lateral pair of rostral spines are short and stout and though acute are not nearly so slender as the median; the distal concavities between the teeth are also much less deep with the result that the undivided basal part is considerably longer. The dorsal processes of the ophthalmic somite consist of two small plates with rectangular antero-lateral angles; in *G. pulchellus* these angles are narrow and acute and are produced obliquely outwards. The distal margin of the telson is in both species divided into four lobes on either side of the median line, but these in *G. nefandus* are merely bounded by grooves on the dorsal surface whereas in *G. pulchellus* they are separated by three incisions, cut right through the telson, which extend about half way to the outer of the three dorsal boss-like protuberances.

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[1] J Wood-Mason, *Figures and descriptions of nine species of Squillidae in the Indian Museum.* Calcutta, 1895.

[2] *G pulchellus* was originally described by Miers as a variety of *trispinosus*, but in my opinion is entitled to rank as a distinct species.

A number of specimens, the largest 39 mm. in length, from the Andamans, Cheduba (Arrakan Coast) and the Straits of Malacca.

Odontodactylus southwelli, sp. nov.

Odontodactylus southwelli is related to *O. hanseni*, Pocock, and *O. latirostris*, Borradaile, and, as in those species, the anterior half of the telson bears three carinae on either side between the median crest and the thickened lateral margin. The outermost of these three carinae is parallel to the external margin and does not diverge to the apex of the lateral spine as in *O. japonicus*. From all species with more than three teeth on the inner margin of the dactylus of the raptorial claw it may be distinguished at a·glance by the enormous size of the eyes.

The rostrum is twice as broad as long and the anterior margin is evenly rounded from side to side. The breadth of the cornea is contained from two to two and a quarter times in the length of the carapace The dactylus of the raptorial claw bears seven to nine teeth on its inner margin in addition to the terminal one. The lateral margins of the sixth and seventh thoracic somites are rounded, the former being a trifle broader than the latter. There are eight carinae on the dorsal surface of the sixth abdominal somite; the first intermediate carina, which alone does not terminate in a spine, is connected proximally by means of a ridge with the submedian. On the margin of the telson there are twelve to sixteen minute submedian spinules, two intermediate denticles and one lateral. In the uropod the outermost of the ten or eleven movable spines which fringe the exopod reaches almost or quite to the apex of the ultimate joint.

Several specimens, the largest 37 mm. in length, from the Andamans and Ceylon.

Lysiosquilla insignis, sp. nov.

This species does not appear to possess much affinity with any form previously described.

The rostrum is triangular, one and a half times as long as wide, and terminates in a sharply acute apex The cornea is set obliquely on the eyestalk and its breadth is about one third the mid-dorsal length of the carapace. The dactylus of the raptorial claw bears seven or eight teeth including the terminal one, the penultimate tooth, as in *L. acanthocarpus*, being noticeably shorter than the antepenultimate. The sixth thoracic somite has an angular dorsal elevation on either side near the anterior edge: antero-laterally the margin is deeply excavate and behind this it projects in the form of a truncate lobe with rounded subrectangular anterior and posterior angles. The postero-lateral angles of the last three abdominal somites are sharply spinous. The fifth somite is provided with two obscure longitudinal carinae on either side; the sixth bears laterally near the distal margin a pair of spines in addition to those at the postero-lateral angles. These spines form the terminations of irregular carinae. The telson is provided dorsally with a trilobed median prominence, on either side of which there is a sharp intermediate spine and an angular lateral lobe. This armature is placed near the distal edge and is homologous with the curved row of spines found in *L. acanthocarpus* and *L. latifrons*; in front of it there are eight longitudinal carinae the outermost of which is proximally bifurcate. On the margin of the telson there are two long movable submedian spines and two pairs of large fixed laterals. There are four short spines between the submedians and the first laterals, and one between the two laterals. Six movable spines fringe the outer margin of the basal joint of the exopodite of the uropod and of these the two outermost are curved and much longer than the next of the series.

One specimen found in the neighbourhood of the Andamans in 235 fathoms.

Squilla gilesi, Wood-Mason, MS.

Squilla gilesi is related to *S. lata*, Brooks, but may readily be distinguished from it by the following characters:—

The carapace in front of the cervical groove is wholly without trace of carinae and its anterior margin on either side of the rostrum is strongly sinuous. The lateral edges of the rostrum are not concave near the apex as in *S. lata* but are evenly convex, and the lateral spinous process of the fifth thoracic somite is longer than in that species and has a stronger forward inclination. There are sharp submedian carinae on the last two thoracic and on all the abdominal somites. The sublateral carinae on the last three or four somites and the lateral carinae on the last four, five, or six terminate in spines. On either side of the median crest of the telson the impressed parallel lines found in *S. lata* are not visible and on the margin there are two or three submedian denticles, five to eight intermediate and one lateral. The inner margin of the bifurcate process of the uropod is finely serrate, not spinous.

The median carina and margins of the telson are strongly swollen in the adult male and the raptorial dactylus, which bears six teeth including the terminal one, is, in this sex, strongly sinuous: convex in the female. In the adult male, also, the propodus of the raptorial claw is very strongly dilated near its distal end.

This species bears a somewhat close superficial resemblance to *S. scorpio*, Latr.; but, apart from such details as the form of the rostrum and the carination of the carapace, there is in *S. gilesi* a well-developed three-jointed mandibular palp, an appendage which in *S. scorpio* is entirely missing.

Thirteen specimens of *S. gilesi*, the largest 94 mm. in length, are in the collection. They were found between 35 and 80 fathoms in the Persian Gulf, Bay of Bengal and Gulf of Martaban.

Squilla hieroglyphica, sp. nov.

This species is closely allied to the little known *S. laevis*, Hess, a form which appears to be restricted to the coasts of New South Wales. Mr. D. G. Stead has kindly presented us with examples of that species and, on comparison, *S. hieroglyphica* shows the following differences :—

The anterior bifurcated portion of the median carina of the carapace is entirely absent; the carapace is much narrower than in *S. laevis*, the anterior width being only about half the median length, including the rostrum. The rostrum is as long as wide and its lateral margins converge to a narrow rounded apex. The cornea of the eyes is set transversely on the stalk. The dactylus of the raptorial claw is armed with only five teeth including the terminal one. The lateral process of the sixth and seventh thoracic somites is more broadly rounded and the sublateral carinae of the fourth abdominal somite end in spines. The denticles on the margin of the telson are represented by the formula 5, 10—12, 1, whereas in *S. laevis* the corresponding numbers are 2—3, 6—8, 1.

Both species agree in having the lateral process of the fifth thoracic somite bilobed and that of the two succeeding somites unilobed, differing in this respect from all other species with the same number (eight) of longitudinal carinae on the abdomen; from both species, moreover, the mandibular palp is absent.

A single specimen of unknown locality, 53 mm. in length, is preserved in the Indian Museum.

Squilla gonypetes, Wood-Mason, MS.

S. gonypetes is closely allied to Brooks' *S. quinquedentata*, but may be distinguished by the following characters :—

The rostrum is distinctly longer and its upturned lateral margins are rather more strongly convergent anteriorly. The cornea of the eyes is a little more expanded and is set very obliquely on the stalk. The antennular peduncle is longer than the carapace excluding the rostrum. The outer inferior margin of the merus of the raptorial claw is distally rounded and does not project in the form of a spine. The sublateral carinae of the last three, and the lateral carinae of the last four abdominal somites end in spines.

Four specimens, the largest 56 mm. in length, from the Persian Gulf, Andaman Is. and the Arrakan Coast.

Squilla boopis, sp. nov.

This species is allied, though not very closely, to *S. quinquedentata* and *S. gonypetes*, and is easily distinguished from both by the enormous size of the eyes.

The rostrum bears a sharp median longitudinal carina in its distal half. The cornea is set very obliquely on the stalk and its greatest breadth is considerably more than one third the median length of the carapace. The antero-lateral angles of the carapace are produced as acute points which project outwards and downwards and scarcely reach at all forwards beyond the adjacent anterior margin. The lateral margin of the seventh thoracic somite is not bilobed but is angled acutely behind and rectangularly in front. The sublateral carinae of the last five and the lateral carinae of all the abdominal somites terminate in spines.

The dactylus of the raptorial claw bears five teeth including the terminal one and the lateral processes of the fifth and sixth thoracic somites are bilobed. In both these characters *S. boopis* resembles the two species mentioned aobve.

A single specimen, 89 mm. in length, from the Gulf of Martaban, 67 fathoms.

Squilla holoschista, Wood-Mason, MS.

This well-marked species is closely allied to *Squilla nepa*, Latr., and agrees with it in the form of the eyes, the number of spines on the raptorial dactylus and the shape of the lateral processes of the fifth to seventh thoracic somites. It may be distinguished by the following characters :—

The median carina of the carapace, in front of the cervical groove, is bifurcated anteriorly for less than one third of its length and is finely bicarinate throughout almost its entire extent. The cornea of the eyes is slightly but noticeably less expanded than in *S. nepa*, specimens of similar size being compared. The submedian carinae of the fourth abdominal somite never end in spines.

In the adult male the distal end of the propodus of the raptorial claw is much broader than in *S. nepa* of the same sex and the external margin of the dactylus is only very feebly sinuous.

Numerous specimens from the east coast of India, from Ceylon to the Ganges delta.

The three following forms are very closely allied to *Squilla oratoria*, de Haan (= *S. affinis*, Berthold), and in order to facilitate comparison the following short account of the principal features which separate that species from its near allies is given :—

The breadth of the carapace, measured at the antero-lateral angles is distinctly less than half its median length, including the rostrum. The median carina of the carapace is bifurcated anteriorly for about one quarter its length in front of the cervical groove and is sharp and distinct throughout its course. The dorsal surface both of the carapace and abdomen is usually strongly punctate and never presents a polished appearance. The anterior margin of the ophthalmic somite, between the bases of the eye-stalks is squarely truncate or emarginate, never pointed. The dorsal carina of the carpus of the raptorial claw bears from three to five sharp tubercles; the outer margin of the dactylus is sinuous. In the bifurcate process from the basal joint of the uropod the margin anterior to the small lobe on the external edge of the longer spine is always strongly concave.

I have reason to believe that this species is found in its typical form only in Chinese and Japanese waters. Three specimens from the Hawaiian and Philippine Is. have also been examined, but these differ from the others in several minute details. They may possibly represent a distinct sub-species, but the material at my disposal is not sufficient to establish this with any certainty.

All previous references of *Squilla oratoria* or *affinis* from localities west of the Philippine Is. are, I believe, based on one or other of the new forms described below, and of this in several instances I have direct proof. In all, several hundreds of specimens have been examined, including a fine collection from many widely distant localities kindly lent by the Trustees of the British Museum.

Squilla oratoria, de Haan, var. **perpensa**, nov.

This variety is distinguished from the typical form by the following characters:—

The median carina of the carapace is interrupted and wholly absent for a short space at the base of the anterior bifurcation. The two arms of the bifurcate portion are frequently very fine and are rarely obsolete. The carpus of the raptorial claw has a sharp elevated carina on its dorsal aspect which terminates abruptly before reaching the anterior margin; apart from this there is no trace whatever of any dorsal tubercle.

Very numerous specimens from localities ranging from Hongkong and N. Australia to the Persian Gulf. The largest example is 107 mm. in length. Four specimens only out of the large series examined exhibit characters intermediate between the variety and the typical form.

Squilla interrupta, Wood-Mason, MS.

This abundant species may be separated from *S. oratoria*, *s.s.*, by the following characters:—

The median carina of the carapace is interrupted at the base of the anterior bifurcated part precisely as in the var. *perpensa*. The breadth of the cornea of the eyes is distinctly less than in either of the two preceding forms, specimens of similar size being compared. The carpus of the raptorial claw is constantly provided with two, and only two, stout dorsal tubercles. In the bifurcate process from the base of the uropod the outer margin of the longer spine anterior to the well-developed lobe is never concave; it is occasionally feebly sinuous, but in nearly every instance is definitely convex.

Very numerous specimens, the largest 119 mm. in length, exhibit the above characters with most remarkable constancy. They were taken at localities ranging from Hongkong to the Persian Gulf.

Squilla wood-masoni, sp. nov.

Squilla polita, Wood-Mason, MS., *nec* Bigelow.

Squilla wood-masoni may be separated from *S. oratoria*, its variety *perpensa* and *S. interrupta* by the use of the following characters:—

The dorsal surface of the carapace and abdomen is smooth, highly polished and without trace of punctuation. The carapace is shorter and broader than in any of the preceding forms, its breadth at the antero lateral angles being *at least* one half its length including the rostrum. The anterior bifurcated portion of the median carina of the carapace is entirely obsolete. The distal edge of the ophthalmic somite is produced to a small point between the bases of the eyestalks and is not truncate or slightly emarginate as in the preceding forms. The eyes are large, much as in *S. oratoria*, and the carpus of the raptorial claw also resembles that species in bearing three or four tubercles on its dorsal edge. The dactylus of the same limb is strongly sinuate externally and is of a much more clumsy build than in any of the preceding forms. The bifurcate process of the uropod is similar to that of *S. oratoria*, but the lobe on the external margin of the longer spine is, in all except very young specimens, much smaller.

Numerous examples, the largest 109 mm. in length, from localities ranging from Hongkong to Aden.

Squilla annandalei, sp. nov.

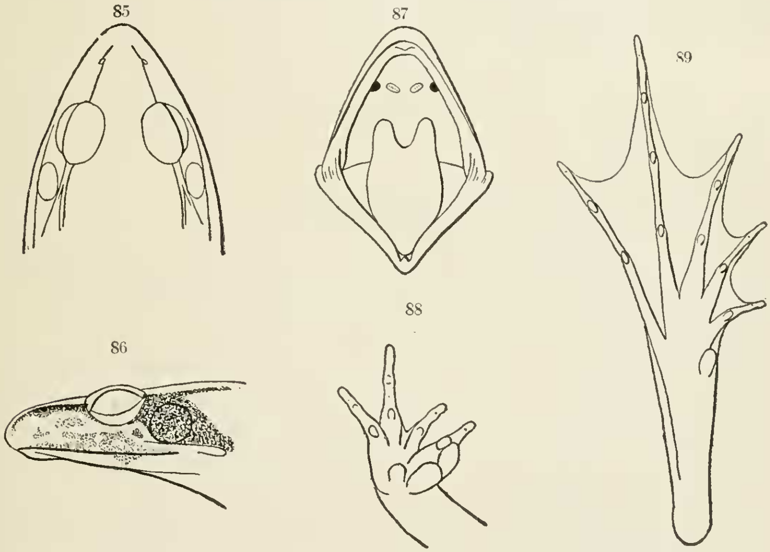
This species is closely allied to the well-known *S. raphidea*, Fabr., and the propodus of the raptorial claw bears, as in that species, a number of large fixed spines along the margin opposed to the dactylus. It may be distinguished by the following features:—

The rostrum is shorter—more so than in the form of *S. raphidea* which de Haan described under the name of *harpax*—and its apex is more broadly rounded. The antennular peduncle is longer than the rostrum and carapace combined. The anterior lobes of the lateral margins of the sixth and seventh thoracic somites are quite distinct, whereas they are wholly obsolete in *S. raphidea*. The sublateral carinae of the last three thoracic and the submedian carinae of the last *two* abdominal somites end in spines. The marginal spines of the telson are sharper than in *S. raphidea* and the inner uropod is narrower in proportion to its length.

Spirit specimens differ noticeably from the allied species in the colour of the inner uropod. This in *S. annandalei* is entirely jet black, except for a pale median longitudinal stripe, whereas in *S. raphidea* the inner margin only is suffused with black pigment.

Four specimens, the longest 115 mm. in length, from the Gulf of Martaban between 53 and 67 fathoms.

than twice its distance from the latter; fingers obtuse, first extending beyond second, and provided with a large double swelling on the inner side, the surface of which is minutely granulated; tip of toes tapering; webs considerably excised, the incision on both sides of fourth toe extending to the distal third of the basal phalanx; subarticular tubercles rather weak; inner metatarsal tubercle rounded, projecting; no outer metatarsal tubercle; tibio-tarsal joint of extended hind leg reaches the snout; total length more than one and three-fourths times the length of tibia; heels overlapping; skin above obscurely shagreened with numerous small rounded tubercles on the back mostly irregularly placed, except those on the shoulder, which form a V-shaped figure with the apex pointing forward; a narrow dorso-lateral glandular ridge on each side from eye to insertion of hind leg, the shortest distance between the two being considerably greater than the distance between the anterior angles of the eyes; underside smooth, except posterior aspect of femurs, which is coarsely granular; a small vocal sac below each corner of the mouth. Color (in alcohol) pale clay-color (Ridgway, Nomencl. Col., pl. v, fig. 8) the dorso-lateral ridge but slightly paler; the latter is marked on the outside by a series of black spots almost forming a continuous line; all the tubercles on the back and sides including the interscapular V marked with a black spot; a blackish brown line from tip of snout through nostril to eye, and a large patch of the same color behind the eye descending obliquely toward the insertion of the fore limb and covering the tympanum; a



FIGS. 85-89.—RANA JAPONICA. 1⅓ × NAT. SIZE. 85, TOP OF HEAD; 86, SIDE OF HEAD; 87, OPEN MOUTH; 88, UNDERSIDE OF HAND; 89, UNDERSIDE OF FOOT. NO. 23549, U.S.N.M.

blackish line on the anterior face of the upper arm and dusky crossbars on the hind legs with round blackish spots on the light interspaces; underside uniform whitish.

Dimensions.

	mm.
Total length, tip of snout to vent	60
Width of head	19
Fore leg	32
Hind leg, tip of longest toe to vent	107
Tibia	34

The *adult female* (U.S.N.M. No. 23548, same locality, date, and collector) is essentially like the male described above, except that the body is broader and the dorso-lateral ridges consequently farther apart, the fore legs less robust, and the swelling on the first finger, which is characteristic of the male sex, absent; the web between the toes is also somewhat more excised. The color is more reddish brown, with scarcely any black spots on the back except those marking the inverted V on the shoulder. Both upper and lower lips are blotched with dark brown.

The *young* specimens are mostly perfectly smooth above, without any tubercles between the dorso-lateral folds.

Variation.—This species offers a great amount of individual variation. The most variable character is the length of the hind legs, for, while in most specimens the tibio-tarsal articulation reaches just beyond the snout, in a few it falls short, while in others it extends considerably farther. The longest hind legs in our collection are possessed by an adult female (No. 31828) collected by Dr. Hugh M. Smith at Yamagawa, Satsuma, Kiusiu, but other specimens in the same lot (for instance, No. 31829) can be exactly matched in every respect by the general run of specimens of corresponding size from central Japan (for instance, No. 34465). The situation of the nostrils relative to the tip of the snout and the correlated length and pointedness of the snout also vary considerably, but in no case have I been able to trace any correlation with length of hind legs or geographic distribution. The color varies greatly; the ground color with regard to the amount and tinge of the brownish or yellowish admixture, the dark spots and bands with regard to intensity and number. Spots are frequently absent, and the male described is rather unusually dotted with black above. The underside is not always uniform white; in many specimens there are brown spots and mottlings on throat or even on chest, but no connection with distribution or structural characters can be discovered.

There is a young specimen in the collection of the Philadelphia Academy of Sciences (No. 15257), collected by Dr. W. H. Jones at Chemulpo, Korea, August, 1890, which appears even more slender and long-snouted than the Japanese specimens, but this may be due to its somewhat dried-up condition. The web between the toes is very deeply excised, however, more so than in any Japanese specimen examined by me.

Habitat.—*Rana japonica*, besides inhabiting Japan, is said to occur also in eastern China. Specimens are on record from Szechuen, Ningpo, the neighborhood of Peking, Kiukiang, and Shanghai, and I have already referred to the specimen from Chemulpo, Korea, in the Philadelphia Academy.

The specimens in the Leiden Museum collected by von Siebold and Buerger (No. 1930) are only labeled as from "Japan." In Museum Senckenbergianum there are specimens from Nikko and Yokohama, in Berlin from Tokyo, in Hamburg from Yamato and Kawachi. In the United States National Museum there are numerous specimens from Yamagawa, Province of Satsuma, Kiusiu; from Shikoku, Yokohama, and from Mount Fuji. Okada has recorded it from the island of Awaji and from the Province of Suwo, Hondo.

The Senckenberg Museum, in Frankfurt on the Main, in 1889 received from the late Mr. B. Schmacker, of Shanghai, several specimens said to have come from Yezo. One of these is now in British Museum (No. 91. 8. 26. 16), where I have had the opportunity of examining it. It is identical with Yokohama specimens and, if the locality is correct, then both *R. japonica* and *R. temporaria* occur in Yezo. It would be very important to have this question thoroughly investigated. The species has not been found there by others and, as it is not claimed that Mr. Schmacker collected the specimens in Yezo personally, confirmation is necessary.[a]

Doctor Boettger has referred two half-grown specimens which were collected by Mr. Schmacker's Japanese collector, either in "Ohoshima or Okinawa," to this species, the only record for the Riu Kius. One might be tempted to regard these as possibly young *Rana holsti* were it not for certain discrepancies in the description, Boettger's specimens having a distinct outer metatarsal tubercle and the tibio-tarsal articulation extending far beyond the tip of the snout. Under these circumstances they are not likely to be from Okinawa or Ohoshima

List of specimens of Rana japonica.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M.	11336	Halfgr.	Japan	1878	E. S. Morse.
Do	11341	do	do	1878	Do.
Do	11342	Young	do	1878	Do.
Do	11343	do	do	1878	Do.
Do	11344	do	do	1878	Do.

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[a] It is to be noted that several other species from the same source are under similar suspicion, as, for instance, *Eumeces latiscutatus* (p. 199) and *Natrix tigrina* (p. 139).

List of specimens of Rana japonica—Continued.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M.	23548	Female[a]	Yokohama, Hondo	Sept., 1896	L. Stejneger.
Do	23549	Male[b]	do	do	Do.
Do	23550	Male	do	do	Do.
Do	23551	do	do	do	Do.
Do	23552	Female	do	do	Do.
Do	23553	do	do	do	Do.
Do	23554	do	do	do	Do.
Do	23555	do	do	do	Do.
Do	23556	do	do	do	Do.
Do	23557	Male	do	do	Do.
Do	23558	Female	do	do	Do.
Do	23559	do	do	do	Do.
Do	23560	do	do	do	Do.
Do	23561	Male	do	do	Do.
Do	23562	do	do	do	Do.
Do	23563	do	do	do	Do.
Do	23564	do	do	do	Do.
Do	23565	do	do	do	Do.
Do	23566	do	do	do	Do.
Do	23567	Female	do	do	Do.
Do	23568	do	do	do	Do.
Do	23569	Male	do	do	Do.
Do	23570	do	do	do	Do.
Do	23571	do	do	do	Do.
Do	23572	Female	do	do	Do.
Do	23573	do	do	do	Do.
Do	23574	Male	do	do	Do.
Do	23575	do	do	do	Do.
Do	31828	Female[c]	Yamagawa, Satsuma, Kiusiu.	June 14, 1903	H. M. Smith.
Do	31829	Adult[c]	do	do	Do.
Do	31830	Young	do	do	Do.
Do	31831	do	do	do	Do.
Do	31907	Male	Kochi, Tosa, Shikoku	May 11, 1903	Do.
Do	31908	Female	do	do	Do.
Do	31909	do	do	do	Do.
Do	31910	do	do	do	Do.
Do	31911	Halfgr	do	do	Do.
Do	31912	do	do	do	Do.
Do	31922	Young	do	do	Do.
Do	31923	do	do	do	Do.
Do	31924	do	do	do	Do.
Do	31925	do	do	do	Do.
Do	31931	do	do	do	Do.
Do	34448	Female	Mount Fuji, Hondo	May, 1898	A. Owston.
Do	34449	do	do	do	Do.
Do	34450	do	do	do	Do.
Do	34451	Male	do	do	Do.
Do	34452	do	do	do	Do.
Do	34453	do	do	do	Do.
Do	34454	Halfgr	do	do	Do.
Do	34455	do	do	do	Do.
Do	34456	do	do	do	Do.

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[a] Description, p. 110.

[b] Description, p. 108, figs. 85–89.

[c] Referred to, p. 110.

List of specimens of Rana japonica—Continued.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	34457	Halfgr.	Mount Fuji, Hondo	May, 1898	A. Owston.
Do	34458	do	do	do	Do.
Do	34459	do	do	do	Do.
Do	34460	do	do	do	Do.
Do	34461	do	do	do	Do.
Do	34462	do	do	do	Do.
Do	34463	do	do	do	Do.
Do	34464	do	do	do	Do.
Do	34465	do	do	do	Do.
Do	34466	do	do	do	Do.
Do	34467	do	do	do	Do.
Phila. Acad	15257	Young[a]	Chemulpo, Korea		W. H. Jones.
Leiden	1930		Japan		Siebold and Buerger.
Brit. Mus	44. 2. 22. 10		do		Do.
Do		([b])	Tokyo		von Martens.
Do	91. 8. 26. 16	([c])	Yezo[?]		B. Schmacker.
Hamburg	1005		Yamato	1896	T. Lenz.
Do	1006		Kawachi	1896	Do.

[a] P. 110.

[b] Cotype of *R. martensi.*

[c] P. 111.

RANA TEMPORARIA[a] Linnæus.

1758. *Rana temporaria* Linnæus, Syst. Nat., 10 ed., 1, p. 212 (type-locality, Europe); 12 ed., 1766, 1, p. 357.—Middendorff, Sibir. Reise, II, Pt. 2, 1853, p. 247, pl. xxvi, figs. 2–4 (River Aldan to Udskoi Ostrog).—Dobrotvorski, Izvest. Sibirsk. Otd. Geograf. Obstch., 1, 1870 (p. 23) (southern Sakhalin).—Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 44 (Europe; Abrek Bay, Amur Prov.); Bull. Soc. Zool. France, 1886, p. 594 (Yezo; Kasakevitch and Abrek Bay, Amur Prov.; Wiloni river; Mongolia); Ann. Mag. Nat. Hist. (6), V, Feb., 1890, p. 140 (Amurland; Yezo); Taill. Batr. Europe, II, 1898, p. 301, pls. xx–xxi.—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg, LX, Prilozh., no. 5, 1889, p. 292 (Sakhalin); Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, 1905, p. 348 (Russia to Amurland, Sakhalin, etc.).

1768. *Rana muta* Laurenti, Synops. Rept., p. 30.

1788. *Rana rufa* Lacèpéde, Hist. Nat. Quadr. Ovip., I, Syn. meth.

1853. *Rana cruenta* Middendorff, Sibir. Reise, II, Pt 2, p. 249, pl. xxvi, figs. 5-7 (southern coast of Okhotsk Sea) (not of Pallas?).—Maack, Putesh. na Amur, 1859 (p. 153) (Amurland).

1855. *Rana fusca* Thomas, Ann. Sci. Nat. (4), IV (p. 365).

1876. *Rana dybowskii* Guenther, Ann. Mag. Nat. Hist. (4), XVII, May, 1876, p. 387 (type-locality, Abrek Bay, near Vladivostok; type in Brit. Mus.; B. Dybowski, collector).—Stone, Proc. Phila. Acad., 1899, p. 183 (Khingan Mountains, eastern Mongolia).

1902. *Rana muta johanseni* Kastchenko, Izvest. Tomsk Univers., 1902 (p. 24).

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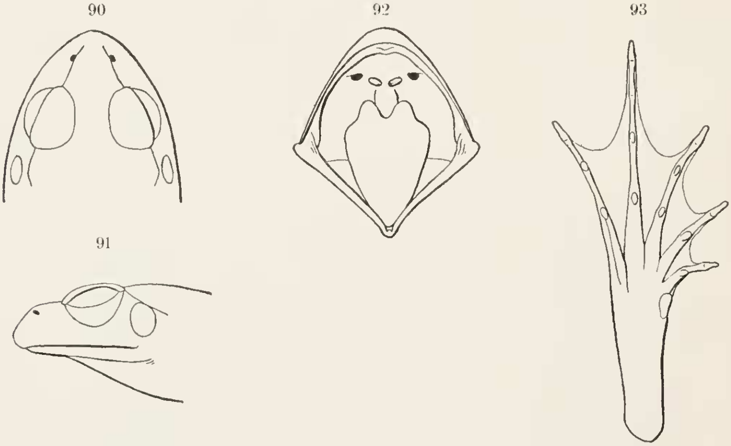
[a] Signifying temporary, in the present case, perhaps, in the sense of changeable. Application somewhat uncertain, but possibly meant for *temporalis*, with reference to the blackish temporal spot.

Various synonyms referable only to some European form or phase are here omitted.

Rana temporaria, as compared with *R. japonica,* is a much more short-legged and short-snouted species with the dorso-lateral folds apparently wider. Altogether it is larger and stouter, the body especially between head and pelvis being relatively longer. Thus in my specimens of *R. temporaria* from Yezo, the length of the foot, measured from inner metatarsal tubercle to tip of longest toes, exactly equals one-half the distance from anterior border of eye to vent, while in *R. japonica* the length of the foot, similarly measured, is about two-thirds the same distance.

I have compared our three Japanese specimens from Yezo with specimens of corresponding sex and size from Norway (for instance, No. 25339, Bergen) and find no tangible differences. The web between the toes is perhaps a trifle more excised, and the inner metatarsal tubercle a trifle stronger, but these differences are clearly within the range of individual variation.



FIGS. 90–93.—RANA TEMPORARIA. 1⅓ × NAT. SIZE. 90, TOP OF HEAD; 91, SIDE OF HEAD; 92, OPEN MOUTH; 93, UNDERSIDE OF FOOT. NO. 23440, U.S.N.M.

Description.—Adult female; U.S.N.M. No. 23440; Sapporo, Yezo; S. Nozawa, collector (figs. 90–93). Vomerine teeth in two slightly oblique groups, the anterior border of which extends forward slightly beyond a line through the posterior border of the choanæ; snout short, rounded, the distance from orbit to tip of snout equaling the distance between black stripes at anterior border of orbit; nostrils nearer the tip of snout than the eye; interorbital space as wide as the upper eyelid and a little narrower than distance between the nostrils; tympanum vertically oval, its greatest diameter about three-fourths the diameter of the eye; distance of tympanum from eye less than one-half the former's greatest diameter; fingers blunt, first finger extending slightly beyond second; incision of web on both sides of fourth toe a trifle deeper than the distal end of the basal phalanx; inner metatarsal tubercle slightly compressed, its length equaling its distance from subarticular tubercle of first toe; no outer metatarsal tubercle; tibio-tarsal joint of extended hind limb reaches center of eye; tibia less than half the length of head and body; heels overlapping by less than interorbital width; skin above and below smooth, except posterior aspect of femur, which is coarsely granulated; the dorso-lateral glandular folds but slightly raised, their shortest distance contained five times in total length. Color (in alcohol) above brownish gray, slightly grayer on snout, with obscure and ill-defined dark-brown mottlings, which on the back and sides occasionally surround a light spot so as to form ocelli; dorso-lateral folds lighter, externally margined by an ill-defined brown line; indications of a dusky band across the top of the head through the center of the upper eyelids; upper lip mottled with brown; a brown line from tip of snout through nostril to eye expanding behind the latter to form the usual dark-brown ear-patch; brown stripe on anterior face of over arm long and parallel with the axis; limbs cross-barred; underside whitish, the whole surface coarsely marbled with brown.

Dimensions.

	mm.
Total length, tip of snout to vent	56
Width of head	17
Fore limb	31
Hind limb, vent to tip of longest toe	87
Tibia	27

Males differ from females in the stronger, more muscular fore limbs, which acquire an extraordinary development during the pairing season; in the pad-like swelling of the inner side of the first finger, which becomes covered with black horny spinules during the same season; in the greater development of the web between the toes; and in the presence of a pair of internal vocal sacs, situated at the sides of the throat.[a]

Variation.—Apparently this species is much less variable than *R. japonica*, especially if we consider its great geographical distribution. The presence of more or less numerous glandular warts on the upper surface and sides, so conspicuously absent in the specimen described above, depends on the season, they being best developed during the breeding time, in museum specimens also to some extent on the state of preservation and the preserving fluid employed. The color, however, varies greatly both as to the tint of the ground color and as to the amount and distinctness of the dark markings, some specimens being nearly uniform above, others densely blotched with blackish.

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[a] Boulenger, Tailless Batrach. Europe, p. 305.

Habitat.—The typical *R. temporaria* occurs in the more northern portions of the Palearctic region, from the British Islands and Scandinavia in the west, to Japan in the east.

In the St. Petersburg Museum there are numerous specimens from the Amur and Ussuri valleys. The Berlin Museum has a specimen from Kasakevitcha near the junction of the Ussuri and Amur rivers, and British Museum has another from Abrek Bay not far from Vladivostok, the type of *R. dybowskii.* In the Hamburg Museum there are specimens from Khabarovka, Poprovka and Nikolayesk, Amurland, collected in 1894 by Dieckmann. Nikolski reports that this frog is not common in Sakhalin, where he found it in the river Duiki and Dobrotvorski in the southern part of the island.

The occurrence of this species in Yezo, therefore, is only what might be expected. British Museum has five specimens from this island, collected by Dr. John Anderson, and our museum has also three Hokkaido specimens collected by Dr. S. Nozawa near Sapporo. In the St. Petersburg Museum there is a specimen from Nemuro, collected by Grigoriew.

For the possible occurence of *R. japonica* in Yezo see under the latter species. Here I may emphasize only the fact that the specimens there alluded to certainly belong to this species and not to *R. temporaria*, and the only question is whether the locality is correctly given or not.

List of specimens of Rana temporaria.

Museum,	No.	Sex.	Locality.	When collected.	By whom collected.
U.S.N.M	23438	Female	Sapporo, Yezo		S. Nozawa.
Do	23439	do	do		Do.
Do	23440	do.[a]	do		Do.
Brit. Mus	86.6.30.18		Yezo		J. Anderson.
Do	19		do		Do.
Do	20		do		Do.
Do	21		do		Do.
Do	22		do		Do.

[a] Description and figs., p. 114.

RANA TSUSHIMENSIS,[a] new species.

Diagnosis.—*Rana temporaria* group; vomerine teeth behind level of choanæ; snout short, the distance from orbit to tip of snout not greater than width between black stripes at anterior border of orbit; tibio-tarsal articulation reaching beyond eye or tip of snout; distance between dorso-lateral glandular folds contained five or six times in length from snout to vent; inner metatarsal tubercle oval, less than one-half its distance from tip of inner toe; first finger extending beyond second; tibia shorter than fore limb; tympanum about one-half the diameter of eye, from which it is separated by about one-half its own diameter; distance between nostrils considerably greater than interorbital width; webs between toes deeply excised, three terminal phalanges of fourth toe being free.

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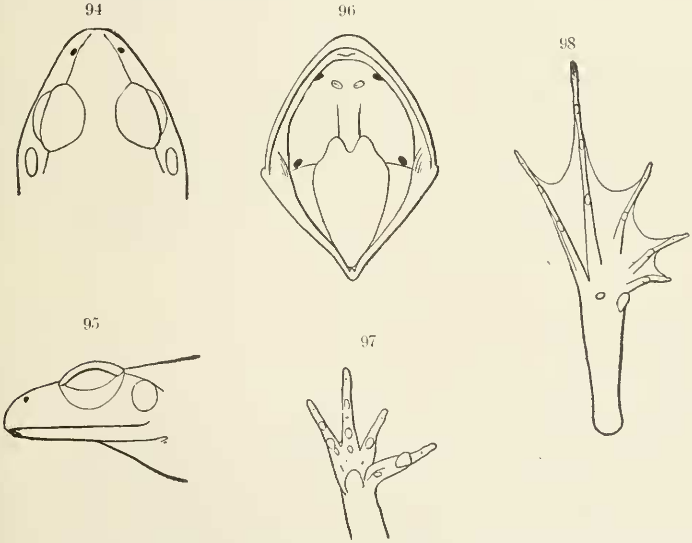
[a] Signifying from Tsushima, in the Straits of Korea, between the south end of Korea and Kiusiu, Japan.

Type.—U.S.N.M. No. 17519; Tsushima; May, 1885; P. L. Jouy, collector.

Habitat.—Tsushima, Japan.

This new species is probably nearest related to *Rana amurensis*. It shares with it the short, rounded snout, and the deeply excised webs, but the inner metatarsal tubercle is considerably stronger and larger. In this respect it agrees with *R. temporaria*, but has more deeply excised webs, narrower interorbital space, narrower dorso-lateral folds, and slightly longer legs, being on the whole of slenderer build. From *R. japonica* it differs by its short, rounded snout and its much shorter hind foot. The vomerine teeth are decidedly further back than in *R. temporaria* and *japonica* though not quite so far as in *R. amurensis*.



FIGS. 94–98.—RANA TSUSHIMENSIS. 1⅓ × NAT. SIZE. 94, TOP OF HEAD; 95, SIDE OF HEAD; 96, OPEN MOUTH; 97, UNDERSIDE OF HAND; 98, UNDERSIDE OF FOOT. No. 17519, U.S.N.M.

Description of type-specimen (figs. 94–98).—Vomerine teeth in two oblique groups their anterior border on a line with the posterior border of the choanæ; snout short, the distance from orbit to tip of snout equals the width between the black stripes at anterior border of orbit; nostrils half-way between eye and tip of snout, their mutual distance being much greater than their distance from the eye or than the interorbital space, which is narrower than upper eyelid; vertical diameter of tympanum greater than horizontal, a trifle more than one-half the diameter of eye, and more than twice the distance of tympanum from eye; first finger slightly extending beyond second; webs of toes deeply excised, barely reaching the middle of basal phalanx of fourth toe; inner metatarsal tubercle oval, projecting, slightly shorter than its distance from subarticular tubercle of first toe; a strong conical outer metatarsal tubercle; subarticular tubercles strongly developed; tibio-tarsal articulation of extended hind leg reaches almost to the nostril; tibia one-half the total length; heels overlapping by the width of the interorbital space; skin above with numerous small scattered granules, those on the sides larger; dorso-lateral glandular folds very narrow and sharply defined, their shortest distance being contained about five times in the total length; lower surface smooth except the proximal half of the posterior aspect of the femur which is granular. Color (in alchol) above uniform pale drab, with a few minute dusky spots on the back; the brown stripe from tip of snout to eye, very narrow, and the tympanic dark patch rather pale and ill-defined between eye and tympanum; humeral stripe and crossbars on limbs obscure; underside uniform whitish.

Dimensions.

	mm.
Total length, snout to vent	52
Width of head	16.5
Fore limb	30
Hind limb, tip of longest toe to vent	83
Tibia	26

The *male* (U.S.N.M. No. 17520; Tsushima; May, 1885; P. L. Jouy, collector) is smaller (total length 37 mm.), with relatively longer tibia (20 mm.). The snout is somewhat shorter, with the nostrils nearer to the tip than to the eye; tympanum slightly larger and nearer the eye; first finger has the swollen pad set with asperities, characteristic of the breeding male; webs less excised, reaching to the anterior third of the basal phalanx of fourth toe; outer metatarsal tubercle barely indicated; tibio-tarsal articulation reaching tip of snout, overlapping by more than interorbital space; shortest distance between dorso-lateral folds one-sixth the total length; lower back and sides with numerous small, white-tipped, pointed tubercles, and in addition on sides large glandular warts. Color like the female, but canthal stripe and ear-patch darker and better defined; underside densely sprinkled with minute brown dots.

Remarks.—Most of the differences between the two specimens as pointed out here are sexual, the relative shorter body, the pad on the first finger, the greater extent of the webs indicating the male. The most notable difference, however, is the presence of the strongly developed outer metatarsal tubercle in the female specimen.

There are a number of specimens from Tsushima, in British Museum, collected by Holst, and in 1898 I was given the privilege of examining them, but I find no reference to the presence of an outer metatarsal tubercle, which may therefore be regarded as problematical. These specimens were referred partly to *R. japonica* and partly to R. *martensi*. My own examination led me to the conclusion that they belong to one species only, as I could not correlate any two of the various differences. They were all short-snouted, with deeply incised webs and narrow dorso-lateral folds.

Habitat.—Only known from Tsushima, in the channel between Japan and Corea, where specimens were collected by P. L. Jouy, in May, 1885, and later by P. A. Holst.

List of specimens of Rana tsushimensis.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.
U.S.N.M	17519	Female [a]	Tsushima, Japan	May, 1885	P. L. Jouy.
Do	17520	Male [b]	do	do	Do.
Brit. Mus.		([c])	do		P. A. Holst.

[a] Type; description, p. 117; figs. 94–98. [b] Description, p. 118. [c] P. 119

RANA AMURENSIS[a] Boulenger.

Plate XI, figs. 2–3.

1853. ? *Rana temporaria* Middendorff, Sibir. Reise, II, ii, Pt. 1, p. 247, pl. xxvi, fig. 3 *a–c* (Eastern Siberia).

1886. *Rana amurensis* Boulenger, Bull. Soc. Zool. France, 1886, p. 598; author's separate (p. 4) (type-locality, Kazakevitch, Amur Province; type, Berlin Mus. No. 9864); Ann. Mag. Nat. Hist. (6), V, Feb., 1890, p. 140, pl. ix, fig. 1[b] (Lake Khanka, Doerries, collector; Chemulpo, Korea); Proc. Zool. Soc. London, 1890, p. 324.— ? Boettger, Ber. Senckenberg. Naturf. Ges., 1894, p. 146 (Chinghai, near Ningpo, China).—Bedriaga, Przewalski Reise, Zool., III, Pt. 1, 1899, (p. 27).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1, 1905, p. 369 (Kuku-Nor, Tibet).

Rana amurensis seems to be closely related to true *R. temporaria*, being round-snouted and short-legged. It differs, however, in the more posterior position of the vomerine teeth which are almost entirely behind the level of the choanæ and, apparently, in having the interorbital space narrower. The inner metatarsal tubercle is also unusually weak. As the two forms occur in the same locality, the Berlin Museum having also true *R. temporaria* (No. 9865) from Kazakevitch, whence came the type of *R. amurensis*, there seems to be no doubt as to the specific validity of the latter.

Having no specimen at command, though it was my good fortune to be allowed to examine the Ussuri and Korean specimens in the British Museum, I print herewith a translation of Boulenger's original description.

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[a] Signifying from Amurland. [b] Reproduced in this work on Plate XI, figs. 2–3.

Original description of type specimen.—Adult male: Berlin Museum, No. 9864; Kazakevitch, Amur Province. Vomerine teeth in two oval groups forming a chevron behind the opening of the inner nares; head rather depressed, as long as broad, or a little longer than broad; snout long and rounded, projecting but little beyond the lip; loreal region rather abruptly bent; nostril halfway between the end of the snout and the anterior corner of the eye; width of interorbital space equaling that of the upper eyelid; tympanum measuring two-thirds the diameter of the eye, separated from the latter by a space equal to one-half of its diameter; first finger not extending beyond the second when placed alongside of it; tibio-tarsal articulation reaching eye when the hind limb is carried forward; tibia much shorter than the fore limb; inner metatarsal tubercle small, oval, blunt; no outer tubercle; subarticular digital tubercles small; toes scarcely two-thirds webbed; back smooth; flanks, lower abdomen, and posterior aspect of the femurs with very large granulations; dorso-lateral folds narrow and but little prominent. Grayish brown above with the ordinary black spots; a blackish band bordered below by whitish along the lip, as in *R. arvalis;* a pale vertebral band rather indistinct; humeral spot very elongated; lower parts spotted with grayish. Male without vocal sacs.

Dimensions.

	mm.
From snout to vent	55
Length of head	18
Width of head	17
Diameter of eye	5.5
Interorbital space	3
Anterior corner of eye to nostril	3.5
Anterior corner of eye to tip of snout	7.5
Diameter of tympanum	3.5
Posterior border of eye to anterior border of tympanum	1.5
Fore limb	34
Hind limb	90
Tibia	28
Inner toe	7
Inner metatarsal tubercle	[a] 1.5

The changes in the description made by him upon the examination of nine specimens from Lake Khanka, are chiefly verbal and qualifying, the most important being the "interorbital space a little narrower than the upper eyelid," an observation which I can corroborate from my own inspection of the same material in 1898. He also adds that the male is provided with black nuptial excrescenses on the thumb.

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[a] Boulenger, Bull. Soc. Zool. France, 1886, p. 598.

Habitat.—Originally described from two specimens collected at Kazakevitch, not far from Khabarovka, a little above the junction of the Ussuri River with the Amur, this species has since been recorded from Lake Khanka and from Chemulpo, Korea. In the Hamburg Museum there are two specimens from Nikolayevsk, Amurland, collected by Dieckmann in 1894 (Nos. 873, 875).

Whether the grown specimens which Boettger (Ber. Senckenberg. Naturf. Ges., 1894, pp. 146–147) records from Chinhai, near Ningpo, China, under the name *Rana amurensis* really belong here is rather doubtful, as he himself does not seem to be quite satisfied with their identity.

Nikolski has recently (1905) identified seven specimens in the St. Petersburg Museum collected at Lake Kuku-Nor, northeastern Tibet, by Przevalski and Grum-Grzymailo as belonging to this species.

List of specimens of Rana amurensis.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected
Brit. Mus.	([a])		Lake Khanka, Amurland		Doerries.

[a] Nine specimens.

RANA IJIMÆ[a] Stejneger.

1901. *Buergeria ijimæ* Stejneger, Proc. Biol. Soc. Washington, XIV, Dec. 12, 1901, p. 190 (type-locality, Okinawa shima; type, Sci. Coll. Mus., Tokyo, No. 19 (914)).

The outward conformation of the terminal digital joint of this species led me to refer it to *Polypedates* (or *Buergeria*). I have since examined more closely into the matter and can find no interpolated bone, so that its proper place seems to be in the genus *Rana*.

The exact nature of the dorso-lateral gland in the unique type specimen is doubtful. The specimen is somewhat soft and the light-colored dorso-lateral lines appear to be glandular and somewhat raised, but whether we have to do with a continuous fold or only a series of longitudinal glands is not certain, although the former condition is more probable.

Description.—*Adult.*—Science College Museum, Tokyo, No. 19 (914); Tanebimura, Okinawa shima, Riu Kiu (figs. 99-103). Vomerine teeth in two slightly oblique series on a line through the posterior border of the choanæ and about equidistant from the latter and from each other; tongue without free, conical papilla; snout somewhat projecting, the nostrils much nearer the tip of the snout than the eyes and nearly vertical over the tip of the mandible; interorbital space slightly narrower than the upper eyelids; canthus rostralis rather abruptly bent; lores concave; tympanum one-half the diameter of the eye; fingers free, first extending slightly beyond second; disks distinct, but small, on third and fourth finger largest, less than half the diameter of tympanum; toes moderately webbed, the two terminal phalanges of fourth toe being free and the excision reaching to the terminal third of the basal phalanx of that toe; disks well developed but small, slightly smaller than those of the fingers; subarticular tubercles very prominent; inner metatarsal tubercle oval, not prominent, small, contained about two and a half times in length of first toe, measured from the anterior border of the tubercle; a distinct outer metatarsal tubercle at the base of fourth toe; no outer dermal fringe on fifth toe, nor a tarsal fold; tibio-tarsal articulations reach considerably beyond tip of snout when hind legs are stretched forward, and overlap by as much as the length of the snout when folded legs are placed at right angles to axis of body; tibia more than one-half the total length of head and body; skin above obscurely shagreened, with a few scattered pustules on the back and numerous ones on the flanks; sides of face and neck and upper side of tibia with numerous white-tipped, pointed asperities, which also stud the

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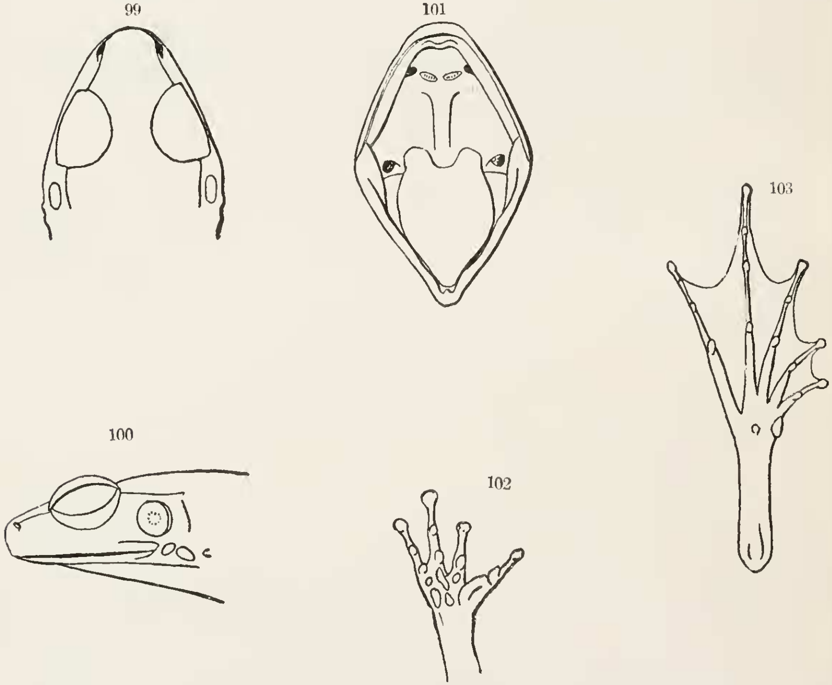
[a] Named in honor of Dr. Isao Ijima, professor of zoology in the Imperial University, Tokyo.



Figs. 99-103.—Rana ijimæ. Nat. size. 99, top of head; 100, side of head; 101, open mouth; 102, underside of hand; 103, underside of foot. No. 19 (914) Sci. Coll. Tokyo.

tympanum like a string of pearls, as well as three large glandular warts behind the corner of the mouth; from the posterior angle of the eye a somewhat indistinct dorso-lateral fold, which on the shoulder seems broken up into a series of shorter longitudinal glands; underside smooth, except posterior aspect of femur, which is granular. Color (in alcohol) dark chocolate brown, apparently nearly uniform, the dorso-lateral folds and upper side of limbs paler, more cinnamon; a whitish line under eye and on posterior part of upper lip, which is mottled with brown along the edge; flanks pale brownish, with irregular blackish spots; legs cross-barred with dark brown and upper posterior aspect of femur mottled with the same color; underside whitish, with very faint brown mottlings on throat, chest, and hind legs.

Dimensions.

	mm.
Total length, tip of snout to vent	68
Width of head	23
Distance between nostrils	7
Distance between nostril and eye	5
Diameter of eye	9
Diameter of tympanum	4.5
Interorbital space	5
Fore leg	44
Largest finger disk	2
Hind leg, vent to tip of longest toe	118
Tibia	38
Inner metatarsal tubercle	2.25

Habitat.—Thus far this species is only known from Okinawa shima, where the type specimen was collected.

List of specimens of Rana ijimæ.

Museum.	No.	Age.	Locality	When collected.	By whom collected.
Sci. Coll. Tokyo	19(914)	Adult[a]	Tanabimura, Okinawa shima.		

[a] Type; description, p. 121; figs. 99-103.

RANA RUGOSA[a] Schlegel.

Plate X, figs. 2-4.

1838. *Rana rugosa* Schlegel, Fauna Japon., Rept., p. 110, Sauri et Batr., pl. iii, figs. 3, 4[b] (type-locality, Japan, probably Nagasaki; types, Leiden Museum No. 2064; von Siebold, collector).—Duméril and Bibron, Erpét. Gén., VIII, 1841, p. 368 (Japan).—Guenther, Cat. Batr. Sal. Brit. Mus., 1858, p. 11 (Japan).—Bleeker, Natuurk. Tijdschr. Nederland Indië, XVI, 1858, p. 204 (Japan).—Hallowell, Proc. Phila. Acad., 1860, p. 499 (part: Simoda).—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 111 (Yokohama); 1876, p. 384 (Nagasaki).—Camerano, Atti. Accad. Torino, XIV,

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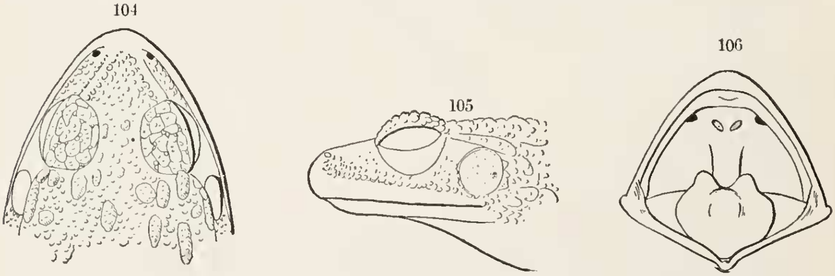
[a] Latin, signifying wrinkled. [b] Reproduced in this work on Plate X, figs. 2–4.

Pt. 5, Apr. 1879, p. 868 (Tokyo, Yokohama).—Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 119 (Yokohama; Hakone Mts.).—Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 35 (Japan).—Okada, Cat. Vert. Jap., 1891, p. 67 (Tokyo; Suwo).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, 1891, p. 239 (Yezo).—Boettger, Kat. Batr. Mus. Senckenberg., 1892, p. 4 (Hakone Lake; Nikko; Yokohama).—Ikada, Annot. Zool. Japon., I, Pt. 3, Aug. 1897, p. 114 (breeding season).

Hallowell's *R. rugosa*[a] belongs only partly to this species, being evidently composed of two species. The small ones "marked 13 in the catalogue . . . found along the mountain streams at Simoda, Japan, May, 1855," which he describes as "presenting the conical pustulations upon the longitudinal elevations upon the back," are in all probability true *R. rugosa*,[b] but the others from "Ousima," and the two larger ones from Simoda, of which the last-mentioned ones are in our collection (U.S.N.M. No. 7415) belong to *R. nigromaculata*. This blunder of Hallowell's is the more remarkable, as *R. rugosa* is one of the most easily recognized species, because of its excessive roughness, which makes it appear more like a toad than a frog. The hollow snout is also quite characteristic.



Figs. 104–106.—Rana rugosa. 1⅓ × nat. size. 104, top of head; 105, side of head; 106, open mouth. No. 23543, U.S.N.M.

Description.—Adult female; U.S.N.M. No. 23543; Yokohama, Hondo; September, 1896; L. Stejneger, collector (figs. 104–106). Vomerine teeth in two small groups, their anterior border on a line through the center of the choanæ and more distant from the latter than from each other; nostrils much nearer the tip of snout than the eye; snout and lores concave, the canthus rostralis forming a ridge separating the two concavities; interorbital space less than width of upper eyelid; tympanum nearly circular, fully three-fourths the diameter of the eye distant from the latter less than one-half its own diameter; fingers not tapering, rounded at end, first somewhat opposable and longer than second, with a small swollen pad at the base; webs of toes full, the excision opposite the distal end of the first phalanx of fourth toe; inner metatarsal tubercle small and rather weak; a weak outer metatarsal tubercle; subarticular tubercles rather weak, the distal one triangular, with the base forward; a decided tarsal fold; tibio-tarsal articulations reach center of tympanum when hind legs are carried forward, and do not overlap when legs are bent at right angles to axis of body; tibia less than one-half the total length; skin above and on sides densely granular, with prominent tubercles in addition to a number of irregular series of short longitudinal ridges, which are largest on the middle of the back, smallest on the head, all these ridges tubercular like the rest of the skin; upper eyelids coarsely tubercular, as also the loreal region; even the tympanum is studded with smaller tubercles; no dorsolateral fold; a number of prominent tubercular glands behind tympanum; underside smooth, but transversely creased, throat and posterior aspect of femurs very coarsely granular. Color (in alcohol) dark brownish olive, with obscure dusky spots and dark cross bands on legs; underneath pale, uniformly and densely mottled with dusky.

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[a] Proc. Phila. Acad., 1860, p. 499.

[b] They are not in the U. S. National Museum.

Dimensions.

	mm.
Total length, tip of snout to vent	56
Width of head	22.5
Fore leg	30
Hind leg, vent to tip of longest toe	83
Tibia	25

The adult male in the breeding season (U.S.N.M. No. 34436; Mount Fuji, Hondo; May, 1898) is smaller, with relatively shorter body, somewhat fuller webs, and a large swelling at the base of the first finger covered with asperities, though not so large as in the species previously described.

There are no vocal sacs, internal or external. Boulenger[a] says: "Male with external vocal vesicles," but as there were then no male specimens in the British Museum he probably had this information from Hallowell, who attributes large vocal vesicles to this species. As I have already shown, the specimens with such, which Hallowell took for *R. rugosa*, were in reality *R. nigromaculata*.

Variation.—On the whole, this species is very uniform, the greater or lesser distinctness of the blackish markings mostly due to a varying shade of the ground color being the chief source of variation. Hilgendorf mentions that one of his specimens (Berlin Mus. No. 4312) lacks the vomerine teeth.

Habitat.—This very distinct species appears to be confined to Japan proper,[b] i. e., to the islands of Hondo, Kiusiu, and Shikoku. Doctor

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[a] Cat. Batr. Sal. Brit. Mus., p. 35.

[b] Von Martens (Preuss. Exped. Ost-Asien, Zool., I, 1876, p. 384) has recorded it from Hongkong, China. The identification, which seems to be by Peters, is probably correct, but the locality is most likely erroneous. Hallowell records two specimens from Ooshima, but they were probably *Rana nigromaculata*, like the male specimens from Simoda, which he also identified as *R. rugosa*.

Fritze is responsible for the statement that it is common in Yezo, but as he is the only writer who records it from that island it may be well to await the arrival of undoubted Yezo specimens. I am not aware that it has been found on Tsushima nor in Korea or any of the Riukiu islands.

The following definite localities from where we have reliable records or have seen specimens may be mentioned: Mountain streams at Simoda (Hallowell); mountains of Hakone (Hilgendorf); Hakone Lake and Nikko (Boettger); Yokohama (von Martens; Hilgendorf; Camerano; Boettger; Stejneger); Tokyo (Camerano); Mount Fuji (Owston); Kobe and Enoshima (Brit. Mus.); Seta, near south end of Lake Biwa, Province of Omi, collected by Dr. T. Lenz (Hamburg Mus. No. 1052); Province of Suwo, Hondo (Okada); Nagasaki (Dr. E. A. Mearns; von Martens). Dr. Hugh M. Smith obtained specimens at Koriyama, Kiusiu, and Kochi, Shikoku; also at Nara, Province of Yamato, Hondo.

The types in the Leiden Museum, which were collected by von Siebold, are only inscribed "Japon."

List of specimens of Rana rugosa.

U. S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected.
11335		Japan	1878	E. S. Morse.
11337		do	1878	Do.
11338		do	1878	Do.
11339		do	1878	Do.
11340		do	1878	Do.
22190		do		(?)
22191		do		(?)
23543	Female[a]	Yokohama, Hondo	Sept., 1896	L. Stejneger.
23544	Adult	do	do	Do.
23545	do	do	do	Do.
23546	do	do	do	Do.
23547	do	do	do	Do.
23587	do	do	do	Do.
26044	do	do	do	Do.
31801	Female	Nara, Yamato, Hondo	1903	H. M. Smith.
31802	do	do	1903	Do.
31813	do	Koriyama, Yamato, Hondo	Apr. 26, 1903	Do.
31814	do	do	do	Do.
31930	do	Kochi, Toza, Shikoka	May 11, 1903	Do.
31932	do	do	do	Do.
34433	do	Mount Fuji, Hondo	May 1898	A. Owston.
34434	do	do	do	Do.
34435	do	do	do	Do.
34436	Male[b]	do	do	Do.
34437	Female	do	do	Do.
34438	Male	do	do	Do.
34439	do	do	do	Do.
34440	do	do	do	Do.
34441	Female	do	do	Do.

[a] Description, p. 124, figs. 104–106.

[b] Description, p. 125.

List of specimens of Rana rugosa—Continued.

U. S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected.
34442	Female	Mount Fuji, Hondo	May, 1898	A. Owston.
34443	do	do	do	Do.
34444	do	do	do	Do.
34445	Male	do	do	Do.
34446	Female	do	do	Do.
34447	Halfgrown	do	do	Do.
35275	Adult	Nagasaki, Kiusiu		E. A. Mearns.
35276	do	do		Do.
35277	do	do		Do.
35278	do	do		Do.
35279	do	do		Do.
35280	do	do		Do.
35281	do	do		Do.
35282	do	do		Do.
35283	do	do		Do.
35284	Halfgrown	do		Do.
35285	Young	do		Do.
35286	do	do		Do.

RANA LIMNOCHARIS[a] Wiegmann.

1835. *Rana limnocharis* WEIGMANN, Nova Acta Acad. Leop. Carol., XVII, Pt. 1, p. 255 (no type-locality; apparently based on specimens in the Leiden Museum from Java, collected and named by H. Boie).—BOULENGER, Fauna Brit. India, Rept., 1890, p. 450 (China and southern Japan to India and Malay Archipelago).—FRITZE, Zool. Jahrb. Syst., VII, 1894, p. 865; author's separate, p. 16 (Okinawa shima).—BOETTGER, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 103 ("Ohoshima or Okinawa").—STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 217 (Taipa and Giilan, Formosa; Botel Tobago Il.; Pescadores Ils.

1835. *Rana gracilis* WIEGMANN, Nova Acta Acad. Leop. Carol., XVII, Pt. 1, p. 257 (type-locality, Cape Syng-more, China; Meyen, collector) (not of Gravenhorst, 1829).—HALLOWELL, Proc. Phila. Acad., 1860, p. 505 (Whampoa, China).—GUENTHER, Rept. Brit. India, 1864, p. 409 (Ningpo; Hongkong; Riu Kiu; Himalayas; Siam; Madras).—MARTENS, Preuss. Exped. Ost-Asien, Zool., I, 1876, p. 383 (Tamsui, Formosa).—BOULENGER, Cat. Batr. Sal. Brit. Mus., 1882, p. 28 (East Indies; Chusan, Ningpo, Shanghai, Szechuen, Hongkong, Hainan, China; Formosa; Riu Kiu); Proc. Zool. Soc. London, 1887, p. 149 (Riu Kiu, Pryer, coll.).—BOETTGER, Offenbach. Ver. Naturk. 24-25 Ber., 1885, p. 159 (Japan).—OKADA, Cat. Vert. Japan, 1891, p. 67 (Okinawa shima).—BROWN, Proc. Phila. Acad., 1902, June 11, p. 185 (Riu Kiu, probably Okinawa shima, Furness and Hiller, coll., 1896).

1858. *Rana vittigera* GUENTHER, Cat. Batr. Sal. Brit. Mus., p. 9 (Ningpo; Hongkong; Riu Kiu; Ceylon; India; Java) (not of Wiegmann, 1835).—MARTENS, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 163 (Tamsui, Formosa).

Several names based on Indian specimens and usually referred to this species are omitted from this synonymy.

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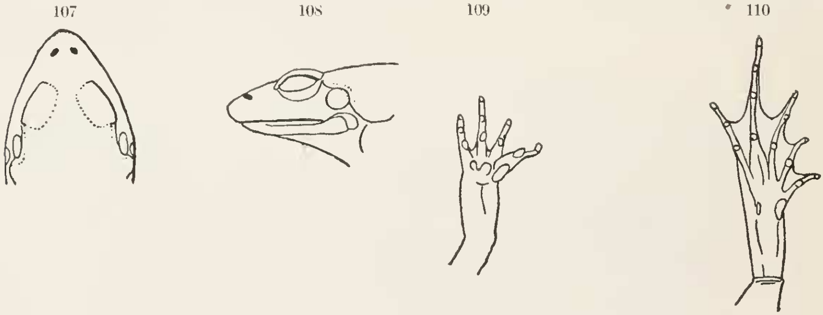
[a] From λίμνη, swamp, pond; χάρις, grace, one of the Graces.

Boulenger[a] regards this species as closely allied to *R. tigerina*, differing in smaller size, half-webbed toes, slight development of the fringe on the fifth toe and usually in the presence of a small outer metatarsal tubercle. One of the chief differences I find, however, is in the situation of the vomerine teeth. In *R. tigerina* they are anterior, approximated very closely to the choanæ, while in *R. limnocharis* they are posterior and quite distant from the choanæ, their distance from the latter being twice as great as their distance from each other.

Description (figs. 107–110).—*Adult female;* U.S.N.M. No. 31798; Onomichi, Prov. Aki, Hondo; June 4, 1903; Dr. H. M. Smith, collector. Vomerine teeth in two oblique groups, the anterior border of which is on a line with the posterior border of the choanæ, their distance from the latter twice as great as their distance from each other posteriorly; nostrils a little nearer the tip of the snout than the eyes; interorbital space about two-thirds the width of upper eyelid; snout convex in cross-section, canthus rostralis rounded; tympanum circular about one-half the diameter of the eye, its distance from the latter more than half of its own diameter; fingers slightly tapering, rounded, first extending much beyond second, and even beyond fourth; a small smooth swelling at base of first finger; web between toes deeply excised to the middle of the basal phalanx of the fourth toe; inner metatarsal tubercle strong, oval, longer than one-half the first toe; a strong conical outer metatarsal tubercle; a narrow dermal fold along the outer side of fifth toe; a fold from inner metatarsal tubercle halfway up the tarsus; tibio-tarsal articulations reach the tympanum when hind legs are stretched forward, and only touch, without overlapping when legs are bent at right angles to axis of body; skin above finely shagreened, with numerous narrow, elongated glandular ridges which become shorter on the sides; no dorso-lateral fold; a deep crease on the chest in front of each arm joining another crease which runs from axilla to axilla across the chest; skin under-



FIGS. 107–110.—RANA LIMNOCHARIS. NAT. SIZE. 107, TOP OF HEAD; 108, SIDE OF HEAD; 109, UNDERSIDE OF HAND; 110, UNDERSIDE OF FOOT. NO. 36501, U.S.N.M.

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[a] Cat. Batr. Sal. Brit. Mus., p. 28, and Fauna Brit. India, Rept., p. 450.

neath nearly smooth becoming coarsely granular posteriorly on the sides, lower belly and posterior half of femurs. Color (in alcohol) above dark reddish gray, with numerous irregular, light-edged dusky blotches; a dark chevron across the head at the center of the upper eyelids, the angle pointing backwards, and a straight dark line across the head at the anterior corner of the eyes; a narrow dark line over canthus rostralis and upper part of tympanum; several broad dark vertical marks on the upper lip and crossing to the lower, one near the tip of the snout, one below the nostrils, two below the eye; some irregular black marks on white ground in the groin; upper posterior aspect of femur marbled black and white in strong contrast; legs cross-barred; underside whitish, throat and chest densely sprinkled with dark gray.

Dimensions.

	mm.
Total length of snout to vent	51
Width of head	18
Fore leg	22
Hind leg, vent to tip of longest toe	68
Tibia	22

The *adult male* (U.S.N.M. No. 23902; Kumamoto, province of Higo, Kiusiu) is smaller (38 mm.), but does not seem to differ materially in proportions; the first finger is provided with copulatory asperities which cover two separate, slightly swollen pads, one basally on the side and below, the other distally and on the upper side of the metacarpal, no asperities on the phalanges; the excision of the web is not quite so deep as in the female; a pair of external vocal sacs on the side of the throat, the openings being behind the tongue near the corner of the mouth. A broad gray band across the throat involving the vocal sacs. A very narrow white line on the upper side along the whole median line is also shown in this specimen, but this character is not sexual.

Variation.—No remarkable variation is found among the Japanese specimens as regards structural characters or proportions. There is some difference in the amount of roughness of the skin on the upper surface, but this is probably due to some extent, at least, to the different state of preservation; one young specimen (No. 30744) from Miyazaki, Kiusiu, is so rough, however, even to the inclusion of the upper eyelids, that it might easily be mistaken for *R. rugosa* were it not for the convex snout, the narrow interorbital space, deeply excised webs, etc. In color there is greater divergence, though in the specimens from Japan proper this is chiefly confined to the presence of a narrow median white line on the back in a few specimens; none of them have the wide pale median line found in some Formosan specimens. This narrow white line is present in all the Ishigaki

Island specimens before me, and in two it is almost as broad as in those from Formosa. In the latter all three styles of coloration are present, irrespective of locality or sex.

Habitat.—This species is distributed over a wide area in southeastern Asia from Japan and China, and according to Boulenger extending throughout India, Ceylon, and Burma to the Malay peninsula and archipelago, ascending to an altitude of 7,000 feet in the Himalayas. Over this range it is probably represented by several subspecies.

It is the commonest species of frog in Formosa and adjacent islands. Von Martens reported it from Tamsui, long ago, and I have recently recorded it from Taipa and Giilan, where this species was collected by Mr. Tada in September and October, 1896. Numerous species collected by him in the Pescadores and in Botel Tobago, April and May, 1897, were reported upon at the same time.

Its occurrence in the Riu Kius was first known through a specimen in British Museum presented by Mr. A. Collie. It was obtained later by Pryer's collectors, and Doctor Fritze found it very common on Okinawa shima. From this island our museum also possesses a specimen (No. 36552) obtained from the Science College Museum in Tokyo. In the Hamburg Museum there are specimens (Nos. 530–531) collected by Doctor Warburg in Myako shima and Iriomote shima, while the U. S. National Museum has a large series from Ishigaki shima, all of the Saki shima group.

It was unknown to the authors of Fauna Japonica, but has since been attributed to Japan in a general way, though with no authentic specimens or definite locality to prove it. We have now in the U. S. National Museum numerous specimens from Kiusiu, two collected at Kumamoto, Province of Higo, on the west side, and one from Miyazaki, Province of Hiuga, on the east side. Doctor Smith brought us two specimens from Yamagawa, Satsuma, and five from Hondo, viz, one from Onomichi, in Aki, and four from Koriyama, in Yamato. Dr. E. A. Mearns obtained several young specimens above Nagasaki. Dr. O. Nordquist, of the Vega Expedition, also obtained it in Nagasaki during October, 1879, and at Hirosami on the 19th of the same month (Mus. Stockholm, Nos. 1034–1035 and 158–165). It almost looks as if this species is extending its range in Japan rapidly, and the inquiry seems legitimate whether it may not owe its presence in Japan proper to a comparatively recent introduction. It seems almost incredible that von Siebold should have missed this species at Nagasaki, if it had really existed there during the time of his residence near that city.

List of specimens of Rana limnocharis.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	22192	Adult	Japan		(?)
Do	22193	do	do		(?)
Do	23902	Male [a]	Kumamoto, Higo, Kiusiu	1884	I. Ijima.
Do	23903	Female	do	1884	Do.
Do	30744	Young	Miyazaki. Kiusiu		C. A. Clark.
Do	31823	Female	Yamagawa, Satsuma, Kiusiu	June 14, 1903	H. M. Smith.
Do	31824	do	do	do	Do.
Do	31798	Female [b]	Onomichi, Aki, Hondo	June 4, 1903	Do.
Do	31809	Young	Koriyama, Yamato, Hondo	1903	Do.
Do	31810	do	do	1903	Do.
Do	31811	do	do	1903	Do.
Do	31812	do	do	1903	Do.
Do	34393	Male	Ishigakishima, Riu Kiu	Apr., 1899	A. Owston.
Do	34394	do	do	do	Do.
Do	34395	do	do	do	Do.
Do	34396	Female	do	do	Do.
Do	34397	do	do	do	Do.
Do	34398	Male	do	do	Do.
Do	34399	do	do	do	Do.
Do	34400	do	do	do	Do.
Do	34401	Female	do	do	Do.
Do	34402	Male	do	do	Do.
Do	34403	do	do	do	Do.
Do	34404	do	do	do	Do.
Do	34405	Female	do	do	Do.
Do	34406	do	do	do	Do.
Do	34407	do	do	do	Do.
Do	34408	Male	do	do	Do.
Do	34409	do	do	do	Do.
Do	34410	do	do	do	Do.
Do	34411	do	do	do	Do.
Do	34412	do	do	do	Do.
Do	34470	do	Northern Formosa	Mar. —, 1903	Do.
Do	34471	do	do	do	Do.
Do	35273	Young	Nagasaki, Kiusiu		E. A. Mearns.
Do	35274	do	do		Do.
Do	36501	Female [c]	Taipa, Formosa	Sept. —, 1896	T. Tada.
Do	36502	(d)	Giilan, Formosa	Oct. —, 1896	Do.
Do	36503	(e)	Botel Tobago Il	May —, 1897	Do.
Do	36504	(f)	Pescadores Ils	Apr. —, 1897	Do.
Do	36552	Male [g]	Okinawa shima		Sci. Coll., Tokyo.
Sci. Coll., Tokyo	26a–c		Taipa, Formosa	Sept. —, 1896	T. Tada.
Do	25a–g		Giilan, Formosa	Oct. —, 1896	Do.
Do	27a–k		Botel Tobago Il	May —, 1897	Do.
Do	28a–d		Pescadores Ils	Apr. —, 1897	Do.

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[a] Description, p. 129.
[b] Description, p. 128.
[c] Sci. Coll. No. 26, figs. 107–110.
[d] Sci. Coll. No. 25.
[e] Sci. Coll. No. 27.
[f] Sci. Coll. No. 28.
[g] Sci. Coll. No. A. 1.

RANA SWINHOANA[a] Boulenger.

1903. *Rana swinhoana* Boulenger, Ann. Mag. Nat. Hist. (7), XII, Nov., 1903, p. 556 (type-locality, Bangkimtsing, Formosa; types, Brit. Mus. Nos. 99. 4. 24. 104–105; J. D. La Touche, collector).

Description of types.—Female. Vomerine teeth in two oblique series between the choanæ; head much depressed, slightly broader than long; snout as long as the diameter of the orbit, rounded; canthus rostralis obtuse; loreal region not very oblique, concave; nostril equally distant from the end of the snout and from the eye; interorbital space as broad as the upper eyelid; tympanum distinct, one-half to three-fifths the diameter of the eye; fingers moderate, first not extending beyond second; toes entirely webbed; tips of fingers and toes dilated into well-developed disks, which are much smaller than the tympanum; subarticular tubercles rather small; a small, oval inner metatarsal tubercle; the tibio-tarsal articulation reaches the tip of the snout; skin smooth, granular on the side; no dorso-lateral fold. Brown above, with small darker spots; a dark canthal streak and a dark temporal blotch; a whitish streak on the upper lip; limbs with rather indistinct dark crossbars; lower parts white.

Dimensions.—From snout to vent 80 mm. (Boulenger's original description).

Remarks.—Doctor Boulenger states that the nearest ally to this species is *Rana livida* Blyth (=*R chloronota* Guenther), the range of which extends from Darjeeling, in the Himalayas, through the mountains of Assam and Tenasserim to Hongkong.

Habitat.—Thus far only recorded from Bangkimtsing, Formosa, where the types were collected by J. D. La Touche.

RANA ISHIKAWÆ[b] Stejneger.

1901. *Buergeria ishikawæ* Stejneger, Proc. Biol. Soc. Washington, XIV, Dec. 12, 1901, p. 190 (type-locality, Okinawa shima; type, Tokyo Imp. Mus. No. 30).

The outward appearance of the last joint of fingers and toes together with the large disks misled me into believing that this species had an interpolated phalanx between the regular ultimate and the penultimate ones, but dissection has failed to discover such a bone, so that it appears safest to refer it to the genus *Rana*.

Description.—Adult: Tokyo Imperial Museum, No. 30; Okinawa shima. (Figs. 111–116.) Vomerine teeth in two short series behind the level of the choanæ; flat above, blunt, descending vertically at the tip; nostril much nearer the tip of snout than eye; canthus rostralis well marked; lores concave; interorbital space slightly wider than upper eyelid; tympanum one-half the diameter of eye and scarcely more than its distance from the latter; fingers free, first extending beyond second almost the length of the disk, and with smooth swelling at base; disks large, about two-thirds the diameter of tympanum, rounded anteriorly; toes moderately webbed, two distal phalanges of fourth toe being free and the excision of the web reaching to the distal third of the basal phalanx of the same toe; subarticular tubercles prominent; a flat, weak, inner metatarsal tubercle, less than one-half the length of the first toe measured from the tubercle; no outer tubercle; a tarsal fold; specimen too hardened to be unbent or legs stretched out, but tibio-tarsal articulation would probably reach between eye and tip of snout; tibio-tarsal articulations of bent hind legs overlapping slightly; skin of upper surface exceedingly rough, even on upper eyelids and sides of face, the tubercles assuming a very extraordinary pattern caused by the smaller tubercles surrounding concentrically a number of large round pustules which are wrinkled radially from the central prominence; sides very roughly studded with closely set, large, wrinkled tubercles; underside finely granular, except posterior aspect of femur, which is coarsely so. Color (in alcohol) above brownish, a network of chocolate brown surrounding the large insular tubercles, which are ochraceous-buff, with the central prominence darker brown; lips pale, blotched with

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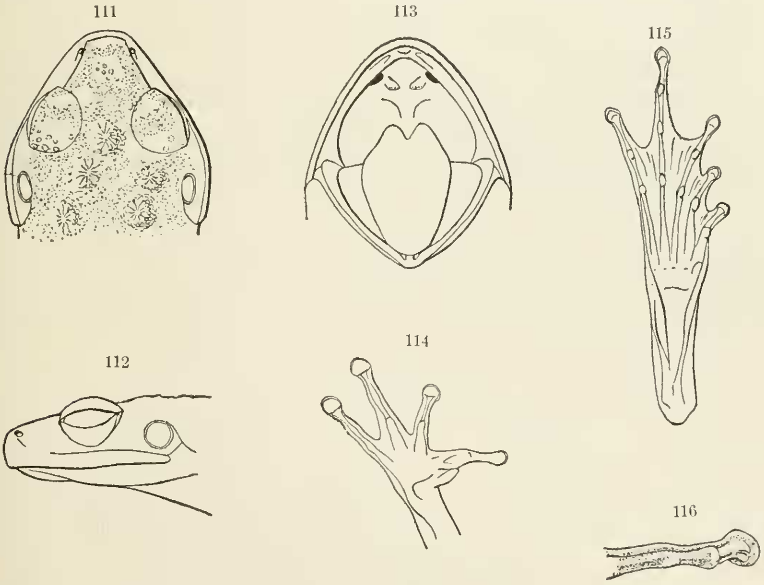
[a] "Named in memory of the late Robert Swinhoe, the first explorer of the reptile fauna of Formosa." See p. 184.

[b] Named in honor of Prof. C. Ishikawa, Imperial University, Tokyo, director of the Department of Natural History of the Tokyo Imperial Museum.



FIGS. 111–116.—RANA ISHIKAWÆ. ⅔ × NAT. SIZE. 111, TOP OF HEAD; 112, SIDE OF HEAD; 113, OPEN MOUTH; 114, UNDERSIDE OF HAND; 115, UNDERSIDE OF FOOT (1⅓ × NAT. SIZE), 1; 116, TIP OF DIGIT. NO. 30, IMP. MUS. TOKYO.

dark brown; limbs crossbarred with dark brown and drab; upper posterior aspect of femur mottled with the same colors; underside pale russet, with a network of obscure whitish mottlings.

Dimensions.

	mm.
Total length, tip of snout to vent (approximately[a])	115
Width of head	40
Distance between nostrils	10
Distance between nostril and eye	8.5
Diameter of eye	12
Diameter of tympanum	6
Interorbital space	61
Width of upper eyelid	9
Fore leg[a]	61
Largest finger disk	4
Hind leg, vent to tip of longest toe[a]	178
Tibia	53
Inner metatarsal tubercle	5.5

Remarks.—This large species is easily recognized by its very peculiar pattern of glandular pustules on the back, which is still more enhanced by the coloration, emphasizing the odd arrangement which suggests a map of the moon, only that there are no craters visible on the top of the volcanoes.

Habitat.—The only specimen thus far known is the type in the Imperial Museum, Uyeno Park, Tokyo, which is said to have come from Okinawa shima.

List of specimens of Rana ishikawæ.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.
Imp. Mus. Tokyo	30	(a)	Okinawa shima		

[a] Type; description, p. 132; figs. 111-116.

RANA NARINA[b] Stejneger.

1901. *Rana narina* Stejneger, Proc. Biol. Soc. Washington, XIV, Dec. 12, 1901, p. 189 (type-locality, Okinawa shima, Riu Kiu; type, Sci. Coll. Mus. Tokyo, No. 19*a*).

Description of type specimen.—Adult; Science College Museum, Tokyo, No. 19*a*; Okinawa shima (figs. 117–121). Vomerine teeth in two distinct, nearly transverse series, which do not extend beyond a line between the posterior margin of the choanæ; the distance between the series a little less than between the latter and the choanæ, which are very large; head longer than wide; snout long, nearly squarish truncate, vertical, the nostrils being situated near the outer extremity, their distance from edge of lip being about one-half their distance from the eyes; lores subvertical, very concave; eyes large; interorbital space narrower than upper eyelids; tympanum very distinct, its diameter about one-half the diameter of the orbit, its distance from the orbit being more than one-half its diameter; several large glandular warts behind the angle of the mouth; fingers rather long, first extending beyond second; terminal disks distinct, but small, much smaller than tympanum; subarticular tubercles large; toes broadly webbed, reaching to the disks of the third and fifth toes; disks about the size of those of the fingers; subarticular tubercles strong; inner metatarsal tubercle but slightly prominent, narrow, less than one-half the length of the inner toe; no outer metatarsal tubercle; fore limbs longer than tibia; tibio-tarsal joint extends considerably beyond the snout; heels overlap considerably when thighs are bent at right angles to the axis of the body; no dorsal or dorso-lateral folds; no tarsal fold; both surfaces smooth. Color (in alcohol) above brownish, below whitish; a narrow whitish line from under the eye to and including the postoral glands; sides and posterior surface of thighs coarsely marbled with dark brown; chin and throat clouded with dusky. The specimen appears to have faded considerably, so that the description of the coloration is probably very defective.

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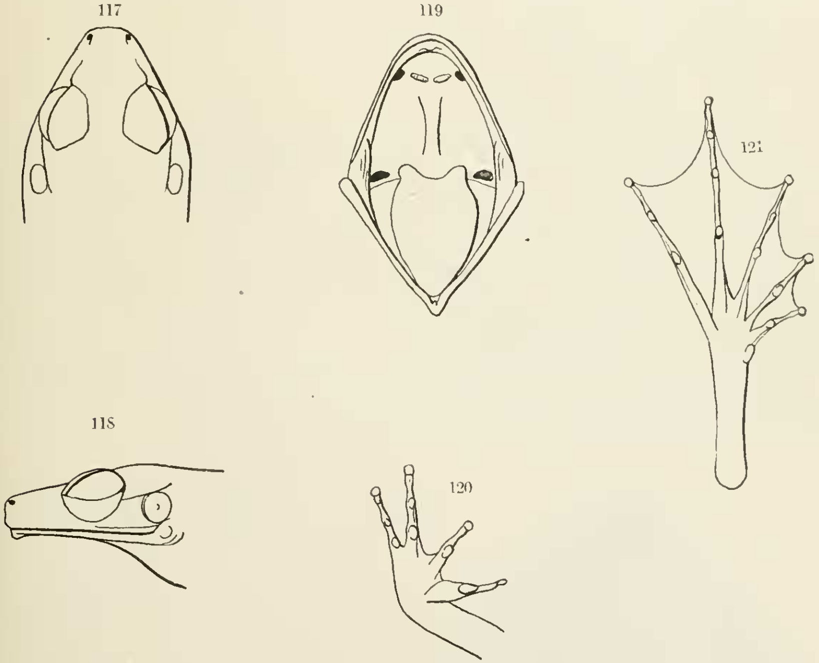
[a] The specimen has the back very much bent and is so hardened that it can not be stretched out to its normal length. For the same reason the legs can not be unbent and their measurements are, therefore, also approximate only.

[b] Having reference to the nostrils, *nares*, on account of their extreme forward position in this species.



Figs. 117–121.—Rana narina. Nat. size. 117, top of head; 118, side of head; 119, open mouth; 120, underside of hand; 121, underside of foot. No. 19*a*, Sci. Coll. Tokyo.

Dimensions.

	mm.
From snout to vent	66
From snout to corner of mouth	22
Length of head	22
Width of head	21
Diameter of eye	7
Width of upper eyelid	6
Interorbital width	5
From eye to nostril	7
From nostril to edge of lip	3.5
From eye to end of snout	8
Diameter of tympanum	4
From eye to tympanum	2.7
From snout to fore limb	23
Fore limb	43
Hind limb	120
Tibia	38
Foot	51

Remarks.—I know of no species to which the present one is particularly closely allied. In some respects it appears to resemble *R. everetti* Boulenger, from the Philippines, particularly in the position of the nostrils, but in detail there are more differences than similarities. The forward position of the nostrils in *R. everetti* is even exceeded in our species, and the vomerine teeth, digital disks, length of hind limb, etc., are totally different.

Habitat.—Only known from the unique type specimen which hails from Okinawa shima, Riu Kiu.

List of specimens of Rana narina.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.
Sci. Coll., Tokyo	19[a]	Adult [a]	Okinawa shima, Riu Kiu		

[a] Type; description p. 134; figs. 117-121.

RANA NAMIYEI[a] Stejneger.

1901. *Rana namiyei* STEJNEGER, Proc. Biol. Soc. Washington, XIV, Dec. 12, 1901, p. 190 (type-locality, Okinawa shima, Riu Kiu; type, Sci. Coll. Mus. Tokyo, No. 31A).

Description.—Adult; Science College Museum, No. 31A; Okinawa shima, Riu Kiu (Figs. 122–126).—Vomerine teeth in two[b] rather large, very distinct, and very oblique series, the anterior end on a level with the posterior border of the choanæ, the distance from the latter being about one-half that between the posterior ends of the vomerines; lower jaw with two greatly developed tooth-like prominences in front, fitting into two deep pits in the upper jaw; head very large, its width at the angle of mouth equals the distance from snout to insertion of fore limb; snout short, truncate, without canthus rostralis; nostril situated half way between eye and median point of upper lip; eyes directed upward; interorbital space one and one-half times as wide as upper eyelid; tympanum hidden; fingers short, slightly dilated at tip, the second one more so than the others, subarticular tubercles well developed; second finger extending considerably beyond first, and falling a trifle short of fourth, which reaches to the penultimate phalanx of third; toes broadly webbed to the tip of the toes, which are somewhat dilated; fourth toe about one-third longer than fifth, which extends only to the middle of third phalanx from the tip of the former, third reaching to the base of the penultimate phalanx; subarticular tubercles well developed, single; inner metatarsal tubercle prominent, with a free outer edge, the width

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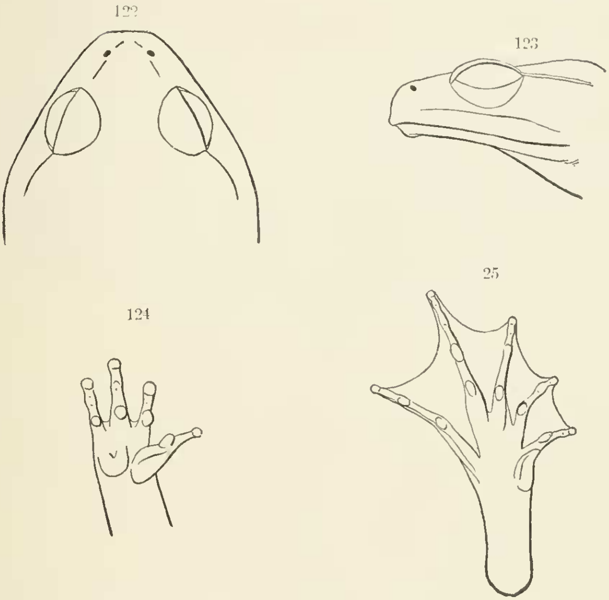
[a] Named for Mr. M. Namiye, of the Science College, Imperial University, Tokyo.

[b] The right one lost in this specimen.



Figs. 122-125.—Rana namiyei. $\frac{2}{3}$ nat. size. 122, top of head; 123, side of head; 124, underside of hand; 125, underside of foot. No. 31a, Sci. Coll. Tokyo.

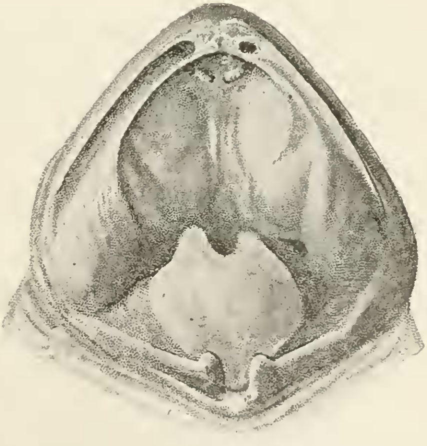


Fig. 126.—Rana namiyei. Nat. size. Open mouth. No. 31a, Sci. Coll. Tokyo.

contained two and one-half times in the length, which about equals the diameter of the eye; no outer tubercle; a well-developed membranaceous fold along the outer edge of the fifth toe; a tarsal fold; the tibio-tarsal joint does not reach the eye; the heels do not meet by a distance greater than the diameter of the eye when the hind limbs are bent at right angles to the axis of the body; skin above nearly smooth, very loose, and apparently transversely wrinkled; a well-marked fold from posterior corner of eye to above fore limb and another less distinct from under the eye backward parallel with the former. Color above brown, with a broad dark band between and including the posterior half of the upper eyelids, with the faintest trace of a lighter band in front of it; lower surface whitish, clouded with dusky, especially on the throat and chin.

Dimensions.

	mm.
From snout to vent	116
From snout to corner of mouth	40
Width of head	53
Diameter of eye	9
Width of upper eyelid	8
Interorbital width	12
From eye to nostril	9
From eye to end of snout	18
From snout to fore limb	48
Fore limb	62
Hind limb	138
Tibia	45
Foot	60
Inner toe	12
Inner metatarsal tubercle	9

Variation.—Another large specimen is in the Science College Museum, collected by Mr. S. Ungawa in Okinawa shima. It has numerous longitudinal tubercular ridges, and the skin is transversely wrinkled on the posterior part of the back only. The interocular light band is very pronounced.

A much smaller specimen in the same museum (No. 18), also from Okinawa shima, and collected by Mr. Nakagawa, differs chiefly in having the head proportionally less broad, the bony tubercles on the mandible less developed, vomerines placed a little more forward, tympanum pretty well defined, and first finger slightly extending beyond second. The skin of the back, eyelids, and thighs is strongly rugose with warts more or less connected by longitudinal ridges; no transverse plaiting. Upper lips with large blackish spots; transverse dark band between eyes very distinct, the light one less so.

At this age it resembles distantly some specimens of *R. tigerina*, from which it differs, however, in most essential points. Thus the nostrils are placed more forward; the interorbital space is much broader;

the vomerine series much shorter and more anterior; shorter tibia; larger inner metatarsal tubercle, etc., not to mention the different coloration.

Remarks.—This species is evidently most nearly related to *R. corrugata*, from Ceylon, and *R. kuhlii*, from southern China and the Malay archipelago, but it shows marked differences from both. From *R. kuhlii* it is easily distinguished by the much longer fifth toe, while it differs from *R. corrugata* in the much larger metatarsal tubercle and the large and prominent groups of vomerine teeth.

Habitat.—Thus far only known from Okinawa shima, Riu Kiu, from which island I have examined three specimens.

List of specimens of Rana namiyei.

Museum.	No.	Age.	Locality.	When collected.	By whom collected.
Sci. Coll. Tokyo	31A	Adult[a]	Okinawa shima, Riu Kiu		
Do		do.[b]	do		S. Ungawa.
Do	18	Halfgr[b]	do		Nakagawa.

[a] Type; description, p. 136; figs. 122-126. [b] Description, p. 138.

RANA TIGERINA[a] Daudin.

1803. *Rana tigerina* Daudin, Hist. Nat. Rain., fol. ed., p. 42; quarto ed. (p. 64), pl. xx (type-locality, Bengal; type in Mus. Paris; Massé, collector); Hist. Nat. Rept., VIII, 1803, p. 125.

1820. *Rana tigrina* Merrem, Tent. Syst. Amphib. (p. 174) (emendation).—Hallowell, Proc. Phila. Acad., 1860, p. 504 (Hongkong).—Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 26 (East Indies; Shanghai, Ningpo, China; Formosa).—Parenti and Picaglìa, Atti Soc. Natural. Modena, Mem. (3) V, 1886, p. 90 (Hongkong market).

1835. *Rana vittigera* Wiegmann, Nova Acta Acad. Leop. Carol., XVII, Pt. 1, p. 255, pl. xxi, fig. 1 (type-localities, Laguna del Bay, Luzon, Philippine Islands, and Macao, China; Meyen, collector).

1835. *Rana rugulosa* Wiegmann, Nova Acta Acad. Leop. Carol., XVII, Pt. 1, p. 258, pl. xxi, fig. 2 (type-locality, Cape Syng-more, China; Meyen, collector).

Several other names, in the synomymies credited to this species, are omitted here as they may be applicable to possible subspecies.

Description (figs. 127–131).—*Adult female:* British Museum, No. 68. 1. 27. 24; Formosa; Doctor Collingwood, collector. Vomerine teeth in two very large oblique series, their anterior border on a level with the anterior border of the choanæ, contiguous with the latter and nearly meeting on the median line; lower jaw with two fairly well-developed tooth-like prominences in front, fitting into pits in the upper jaw; width of head at angle of mouth equaling the distance between tip of snout and insertion of fore leg; snout rather short and rounded without canthus rostralis; nostrils situated about halfway between eye and tip of snout; interorbital space much narrower than upper eyelid; tympanum distinct, about three-fourths the diameter of the eye; fingers tapering, not dilated at tips; second finger shorter than first, about equaling fourth; toes nearly entirely webbed, not dilated at tips; a rather wide flap of skin bordering the outer side of the fifth toe, the flap being particularly wide along the metatarsal bone; subarticular tubercles moderate; inner metatarsal tubercle small, its length scarcely one-half the diameter of the eye; no outer tubercle; a tarsal fold; tibio-tarsal joints reach eyes when hind legs are stretched forward along the side and meet when bent at right angles to the axis of the body; skin above with numerous, very distinct, longitudinal, short, glandular ridges, but no transverse fold, and no dorso-lateral fold; a well-marked fold from posterior corner of eye around upper edge of tympanum to above fore leg. Color brown above with numerous roundish dark spots; no vertebral light line; lower surface whitish with brownish marblings on throat and chest; thighs strongly marbled with dark brownish.

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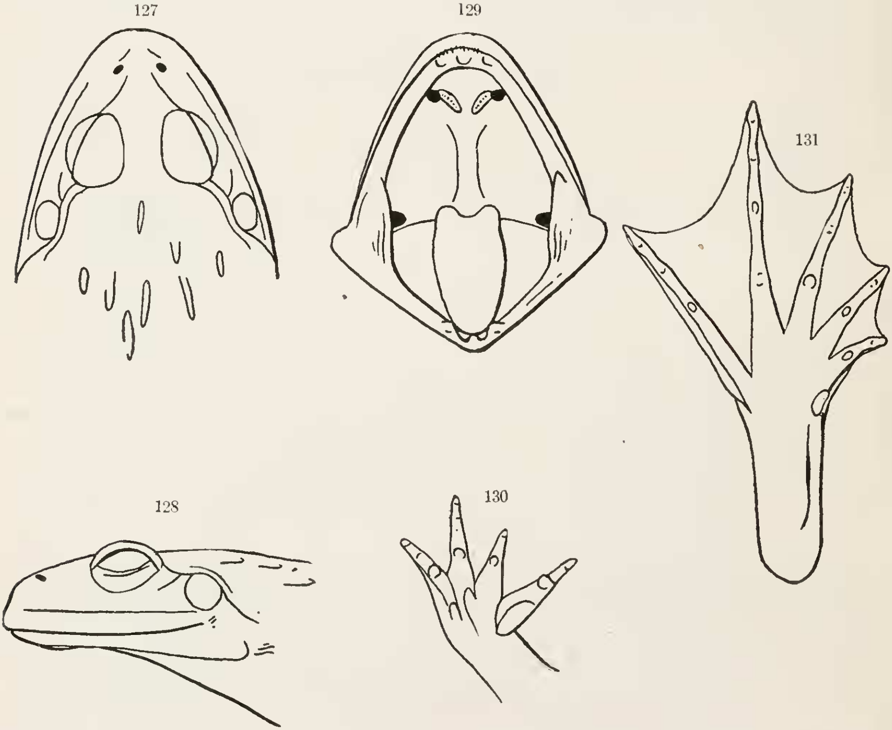
[a] Careless form for *tigrinus*, spotted or barred like a tiger, *tigris*.



Figs. 127-131.—Rana tigerina. Nat. size. 127, top of head; 128, side of head; 129, open mouth; 130, underside of hand; 131, underside of foot. No. 7435, U.S.N.M.

Dimensions.

	mm.
Total length, tip of snout to vent	88
Width of head	32
Snout to corner of mouth	30
Diameter of eye	8
Diameter of tympanum	6
Width of upper eyelid	8
Width of interorbital space	5
Eye to nostril	8
Eye to tip of snout	14.5
Snout to fore leg	34
Fore leg	46
Tibia	39
Inner metatarsal tubercle	4

The *adult male* (U.S.N.M. No. 34392; northern Formosa) differs chiefly in the presence of copulatory excrescences on the side of the first finger, which is somewhat swollen at base, and by the two large external vocal sacs, located one on each side of the throat.

The *tadpoles* of this species have been described and figured by Mr. Stanley S. Flower from Siamese specimens.[a] His description, drawn up from specimens obtained in June, 1897, at Ayuthia, Siam, is herewith given in full.

Length of body once and a half its width, rather more than half length of tail; nostrils a little nearer to the eyes than to the end of the snout; eyes on the upper surface of the body, nearer the end of the snout than the spiraculum, the distance between the eyes twice the distance between the nostrils, and about equal to the width of the mouth; spiraculum on the left side, directed backward and upward, a little nearer the anus than the end of the snout, visible from above and from below; anus opening on the right side. Tail from three and one-half to four times as long as deep; acutely pointed; upper crest convex, a little deeper than the lower, not extending on to the back; depth of the muscular portion at its base about half the greatest total depth. Mouth: the large powerful beak is entirely black; the upper mandible terminates in front in a long sharp tooth-like prominence; the lower mandible is bicuspid, each "tooth" being long and sharp; the lips are bordered with very short fleshy papillæ; inside the upper lip are five series of fine, black teeth; the first series is uninterrupted by the individual teeth being "grouped with intervals" about the center of the line; the remaining series are broadly interrupted, the fifth being very short and difficult to distinguish; the lower lip has also five series of teeth; the first is short and uninterrupted, the second long and uninterrupted, the remainder broadly interrupted and very short. Color (in life), above yellowish brown, mottled with darker brown, a very distinct dark brown crescent-shaped mark above each nostril; below white, purplish gray about the chin and throat; tail yellow, mottled with brown, a horizontal dark line along the median line of the basal third of the muscular portion; iris golden. Total length 52 mm.; length of body 18.5; width of body 12.5; length of tail 33.5; depth of tail 9.

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[a] Proc. Zool. Soc. London, 1899, pp. 892–893, pl. LIX, figs. 2–2*a*.

Variation.—This is the largest species of frog in that part of the world which is included in the present work. The female described above is small. Another Formosan specimen in our collection (U.S.N.M. No. 34390), measures 131 mm. from snout to vent, and specimens from other localities as large as 165 mm. are on record. The males are smaller, our largest from Formosa (U.S.N.M. No. 34392) measuring only 94 mm. in total length. The hind legs appear also to be shorter, inasmuch as the tibio-tarsal articulation does not reach even the tympanum. The ground color in our specimens is not brownish but olive, and the color in life is probably some shade of the latter tint.

Remarks.—Specimens from Borneo, which I had the privilege of examining in British Museum, have the vomerine groups of teeth more oblique and separated from the choanæ by a space fully equal to that between the two patches. I can not, therefore, agree in regarding *Rana schlueteri* Werner as a synonym. Chinese specimens in our museum (U.S.N.M. No. 7435; Hongkong; W. Stimpson, collector) agree with the Formosan specimens as described.

Habitat.—Widely distributed from India and Ceylon through Burma and Pegu to the Malay peninsula and archipelago,[a] Celebes, and the Philippine Islands; eastward it extends into southern China, where it occurs as far as Ningpo and Shanghai.

Its occurrence in Formosa is attested by four female specimens in British Museum, collected at various times by Swinhoe, Dickson, and Collingwood, and by three specimens, male and female, in the United States National Museum from northern Formosa, obtained through Mr. A. Owston.

List of specimens of Rana tigerina.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	7435	(a)	Hongkong, China		W. Stimpson.
Do.	34390	Female	Northern Formosa	May —, 1903	A. Owston.
Do.	34391	Male	do	do	Do.
Do.	34392	do.[b]	do	do	Do.
Brit. Mus.	68.1.27.24	Female[c]	Formosa		Doctor Collingwood.
Do.	68.1.27.25	do	do		Do.

[a] Figs. 127–131. [b] P. 141. [c] Description, p. 139.

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[a] Note, however, the observations made above under the heading of "Remarks."

Genus POLYPEDATES[a] Tschudi.

1838. *Rhacophorus* TSCHUDI, Classif. Batr., pp. 32, 73 (type, *R. reinwardtii;* not of Schlegel 1827).
1838. *Theloderma* TSCHUDI, Classif. Batr., pp. 32, 73 (type, *T. leprosa*).
1838. *Buergeria* TSCHUDI, Classif. Batr., pp. 34, 75 (type, *Hyla buergeri* Schlegel).
1838. *Polypedotes* TSCHUDI, Classif. Batr., p. 34 (type, *P. leucomystax*).
1838. *Polypedates* TSCHUDI, Classif. Batr., p. 75 (correction).
1843. *Trachyhyas* FITZINGER, Syst. Rept., p. 31 (type, *Polypedates rugosus=P. leucomystax*).
1848. *Dendricus* GISTEL, Naturg. Thierr., p. viii (substitute for *Buergeria*).
1890. *Polypedetes* COUES, Century Dictionary, IV, p. 4606 (emendation).

Authors who reject Fitzinger's generic names of 1843 as *nomina nuda*, in spite of the fact that they are accompanied by an explicit statement of type, are not always consistent, as for instance in the present case.

In Oken's Isis for 1827 Schlegel made a number of perfunctory remarks about various herpetological matters, in which he mentioned several manuscript names of genera instituted by Kuhl or H. Boie. Among these is also *Rhacophorus*, which is introduced (p. 294) in the following words:

"Nach *Hyla* reiht Kuhl sein neues Geschlecht: *Racophorus* ein. Sp.: *Rac. reinwardtii Kuhl n. sp., palmatus Kuhl* (*Hyla Daud.*), *moschatus Kuhl n. sp.*, und noch zwey unbenannte Species vom Herrn Professor Reinwardt mitgebracht."

That is all. A generic name without the slightest trace of a definition or description accompanied by three specific names, two of which are nomina nuda, as one (*R. reinwardtii*) was only described many years after, the other (*R. moschatus*) apparently never. Only one of the species mentioned could be recognized when the generic name was published, viz, Daudin's *Hyla palmata*, which of necessity must be the type. And as this species is a typical *Hyla*, *Racophorus* of 1827 becomes a synonym of this genus. Any other result is preposterous, for certainly a generic name without diagnosis to be tenable can not well have for type an undescribed species.[b] And yet *Rhacophorus* is accepted by those who even refuse to quote Fitzinger's genera in the synonymy. Even the rehabilitated *Rhacophorus* of Tschudi (1838) is not in a much better position, since the species assigned to it were not described even then, as the part of Schlegel's "Abbildungen" containing the first description of *Rhacophorus reinwardtii* was published after Tschudi's work [c] appeared, but it is plainly untenable in view of the different application of the name in 1827.

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[a] From πολὺ, much; πηδάω, I jump.

[b] That the genus *Rhacophorus* was understood in this sense by herpetologists before Tschudi's time is shown by van der Hoeven's use of *Racophorus* in 1833 (Handb. Dierk., II, Pt. 2, p. 311) for *Hyla palmata, faber* and *crepitans*.

[c] Tschudi, Classif. Batr., p. 32.

I have not alluded to Kuhl's own application of *Rhacophorus* in 1822,[a] because it was certainly unidentifiable at the time. He refers, it is true, to the dermal flap at the heel,[b] but in so uncertain a way that the genus without reference to a described or figured species (and no species was described until twenty-five years afterwards) must have been completely unintelligible. The fact that we know now what he meant is not sufficient.

Polypedates, or *Polypedotes*, *Buergeria*, and *Theloderma* were proposed by Tschudi simultaneously for two different species of the same genus, *Theloderma* being mentioned first. Duméril and Bibron, however, in 1841, in combining the first two genera, selected *Polypedates* for the greater group, and Guenther, in 1887, merged *Theloderma* in *Polypedates*, hence this name must be adopted according to article 28 of the International Zoological Code of Nomenclature.

The genus *Polypedates*, as here understood, differs from the genus *Rana* chiefly in the presence of a small bone intercalated between the last phalanx of the digit and the normally penultimate one. Externally this arrangement is marked on the upper surface by a kink or notch just before the widening of the disk, thus rendering dissection in most cases unnecessary. However, it is much safer to dissect, as shown by the erroneous reference of *Rana ijimæ* and *Rana ishikawæ* to the present genus.

KEY TO THE JAPANESE AND FORMOSAN SPECIES OF POLYPEDATES.

- a^1 Fingers considerably webbed; color above green (blue or purplish in alcohol), immaculate.
  - b^1 A distinct outer metatarsal tubercle; dermal margin of fingers much narrower than the bone.......................................*P. schlegelii*, p. 145.
  - b^2 No outer metatarsal tubercle; dermal margin of fingers equaling the bone in width.
    - c^1 Distance from tip of coccyx to end of sacral diapophysis equals the width of the head.......................................*P. viridis*, p. 147.
    - c^2 Distance from tip of coccyx to end of sacral diapophysis much less than width of head.......................................*P. owstoni*, p. 149.
- a^2 Fingers free, or with only a rudiment of web at base; color above brownish, more or less marked with darker.
  - b^1 Tibia about one-half the length of head and body.
    - c^1 Vomerine teeth in two long straight series between the choanæ, each series considerably longer than interval between them.........*P. buergeri*, p. 150.
    - c^2 Vomerine teeth in two small oval series, each series considerably shorter than the interval between them..........................*P. eiffingeri*, p. 153.
  - b^2 Tibia more than one-half the length of head and body.
    - c^1 Interorbital space narrower than upper eyelid; tympanum less than one-half the diameter of the eye.............................*P. japonicus*, p. 155.
    - c^2 Interorbital space wider than upper eyelid; tympanum more than one-half the diameter of the eye.............................*P. leucomystax*, p. 157.

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[a] Isis, 1822, p. 476.

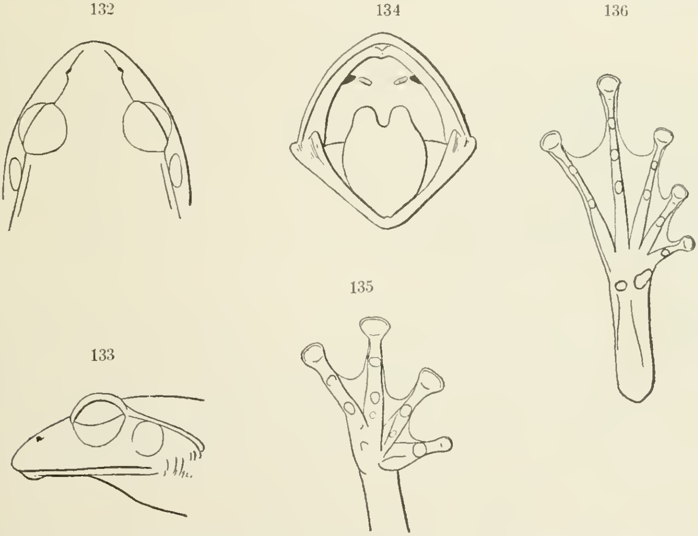
[b] This dermal heel flap is also found in *Hyla palmata*, and consequently is not diagnostic. As a matter of fact, the latter species being the only one known at the time, the genus was at first restricted to it, as shown above.

POLYPEDATES SCHLEGELII[a] Guenther.

1858. *Polypedates schlegelii* Guenther, Cat. Batr. Sal. Brit. Mus., p. 81, pl. vi, fig. c (type-locality, Japan; types in Brit. Mus.).—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 111; 1876, p. 383 (Yokohama).—Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 120 (Tokyo; Tsukuba Mt., Hitatchi Prov.).—*Rhacophorus schlegelii* Boulenger, Cat. Batr. Sal. Brit. Mus., 1882, p. 86, pl. ix, fig. 1 (Japan).—Okada, Cat. Vert. Japan, 1891, p. 67 (Aizu, prov. Iwashiro; Tadam; Tokyo).—*Racophorus schlegelii* Ikeda, Annot. Zool. Jap., I, Pt. 3, Aug. 1897, p. 113 (Aizu, prov. Iwashiro; Tokyo; breeding habits).

1892. *Rhacophorus schlegeli* Boettger, Kat. Batr. Mus. Senckenberg., p. 16 (Hakone Mts.; Yokohama).

Description.—Adult female; U.S.N.M. No. 23589; Yokohama, Hondo; September, 1896; L. Stejneger, collector (figs. 132–136).



Figs. 132–136.—Polypedates schlegelii. 1⅓ × nat. size. 132, top of head; 133, side of head; 134, open mouth; 135, underside of hand; 136, underside of foot. No. 23589, U.S.N.M.

Vomerine teeth in two nearly straight series between and close to the choanæ, each series shorter than the distance between them; snout declivous; nostrils slightly nearer the eye than the tip of snout; interorbital space more than one and a half times the width of upper eyelid; tympanum circular, about two-thirds the diameter of the eye; fingers webbed, between third and fourth to distal end of basal phalanx, the others at base only; first finger much shorter than second, not even reaching the disk of the latter; disks of second, third, and fourth fingers large, about three-fourth the diameter of the tympanum, that of the first small, all slightly rounded anteriorly; toes nearly entirely webbed; disks large, but smaller than those of fingers, gradually decreasing in size from fourth toe; a pear-shaped inner metatarsal tubercle, as large as one-half the first toe, rounded; a large, but not prominent outer one; tibio-tarsal articulations reach posterior border of eye, and do not meet when hind legs are placed vertical to the axis of the body; skin above very finely shagreened; no dorso-lateral folds; a strong fold from posterior border of eye over tympanum to shoulder; skin on underside granulated, the granulation increasing in coarseness from the throat backward. Color above in life green, in alcohol dull marine blue; beneath yellowish, as are also the upper surface of the two inner fingers, the three inner toes, and disks of all the digits; a few dusky spots on posterior aspect of femur; no crossbars on legs.

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[a] Named in honor of Dr. Hermann Schlegel, director of the Rijksmuseum at Leiden, and the chief author of the herpetological portion of "Fauna Japonica." Born, January 19, 1804, in Altenburg, Germany; died in Leiden, January 17, 1884.

Dimensions.

	mm.
Total length, tip of snout to vent	49
Width of head	18
Interorbital space	6
Upper eyelid	3.5
Diameter of eye	5
Diameter of tympanum	3.3
Diameter of largest finger disk	3
Fore leg	29
Hind leg, vent to tip of largest toe	68
Tibia	20

Variation.—There is apparently very little external difference between the sexes. The *male* is said to have an internal vocal sac, and No. 34373, a May specimen, has the throat suffused with dark gray, which the others collected in the same locality and at the same time do not.

There is some variation in the length of the vomerine series, so that the internal is not often so great as in the specimen described. The tympanum is often smaller and the declivity of the snout is not always equally great.

Habitat.—This species is apparently confined to Japan. Thus far it is only recorded from Kiusiu (Miyazaki, U. S. Nat. Mus.) and Hondo as far north as 37° N. L. (Aizu, prov. Iwashiro, according to Okada). It is not uncommon in the woods near Yokohama (von Martens, Boettger, Stejneger) and Tokyo (Hilgendorf, Okada). Hilgendorf also records it from the Tsukuba Mountain, northeast of Tokyo in the province of Hitatchi, while Boettger has it from the mountains near Hakone. We also have four specimens from Mount Fuji, and in the Stockholm Museum there is one specimen collected by Dr. O. Nordquist at Enoshima. It is not found in Yezo, and is replaced in the Riu Kius by the next form.

List of specimens of Polypedates schlegelii.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	23589	Female [a]	Yokohama, Hondo	Sept., 1896	L. Stejneger.
Do	23590	do	do	do	Do.
Do	23591	do	do	do	Do.
Do	30741	Halfgrown	Miyazaki, Kiusiu		C. A. Clark.
Do	34370	Male	Mount Fuji, Hondo	May, 1898	A. Owston.
Do	34371	do	do	do	Do.
Do	34372	do [b]	do	do	Do.
Do	34373	do	do	do	Do.
Leiden	[c] 1694		Japan		v. Siebold.

[a] Description, p. 145; figs. 132-136. [b] P. 146. [c] About 10 specimens.

POLYPEDATES VIRIDIS[a] Hallowell.

1860. *Polypedates viridis* HALLOWELL, Proc. Phila. Acad., 1860, p. 500 (type-locality, Okinawa shima, Riu Kiu; type, U.S.N.M. No. 25397; W. Stimpson, collector). *Rhacophorus viridis* BOULENGER, Proc. Zool. Soc. London, 1887, p. 149 ("Loo Choo Islands;" Pryer collection).—FRITZE, Zool. Jahrb. Syst., VII, 1894, p. 865; author's separate, p. 16 (Okinawa shima).—BOETTGER, Offenbach. Ver. Naturk. 33-36 Ber., 1895, p. 106 (Okinawa shima).—BROWN, Proc. Phila. Acad., 1902, June 11, p. 185 ("Loo Choo Islands," probably Okinawa shima; Furness and Hiller, collectors).

The relationship of this form to *P. schlegelii* is very close indeed, so close that all my attempts to draw a hard and fast line based upon differences in proportion between hind legs and total length, distance of nostrils from eye, relative size of tympanum and large finger disks, etc., have failed in a large series. It seems, however, that the narrowness of the dermal margin of the digits in the northern form is a fairly good characteristic, inasmuch as the fingers appear slenderer and the disks consequently more differentiated, though in reality they are relatively smaller than in the southern forms. It is also possible that a larger series of the Okinawa form would show it to have slightly longer hind limbs, although in the only specimen before me the tibia is less than half the total length, notwithstanding the fact that the specimen is very much hardened, with the back bent at nearly 60 degrees. This specimen has also a very weak inner metatarsal tubercle, and the outer one is scarcely noticeable, and as Boulenger has also commented upon the smallness and flatness of the former in the specimen examined by him, it may be that we here have an additional character.

Under these circumstances it is unnecessary to submit a detailed description of this form, but a set of measurements of Science College

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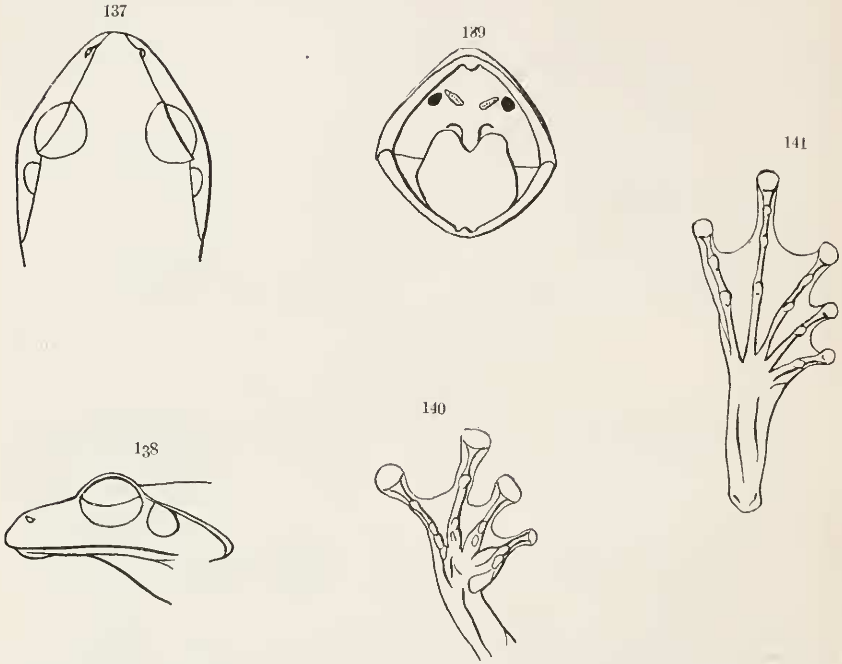
[a] Latin word, signifying green.

Museum, No. 27 (figs. 137–141) from Okinawa shima is here submitted for comparison with those of a *P. schlegelii* given on page 146.



FIGS. 137–141.—POLYPEDATES VIRIDIS. NAT. SIZE. 137, TOP OF HEAD; 138, SIDE OF HEAD; 139, OPEN MOUTH; 140, UNDERSIDE OF HAND; 141, UNDERSIDE OF FOOT. NO. 27, SCI. COLL. TOKYO.

Dimensions.

	mm.
Total length (back strongly bent)	67
Width of head	25
Interorbital space	8.5
Upper eyelid	5.5
Diameter of eye	8
Diameter of tympanum	5
Diameter of largest finger disk	5
Fore leg	44
Hind leg (approximate)	110
Tibia	31

According to the manuscript notes of Doctor Stimpson the color during life (of specimens taken in December) is "grass green[a] above, below pale red; no dark line of separation between these colors."

Habitat.—Originally described from Okinawa shima, this species has been collected there by nearly all the travelers who have visited that island, where, according to Doctor Fritze, it is not rare.

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[a] Not "pale green" as rendered by Hallowell.

List of specimens of Polypedates viridis.

Museum.	No.	Age.	Locality.	When collected.	By whom collected.
U.S.N.M	25397	([a])	Okinawa shima	Dec., 1854	W. Stimpson.
Sci. Coll. Tokyo	27	Adult [b]	do		

[a] Type; poor condition.

[b] Dimensions, p. 148; figs. 137-141.

POLYPEDATES OWSTONI,[a] new species.

Diagnosis.—Similar to *Polypedates viridis* and like it having the dermal margin of fingers equaling the bone in width; nostrils at least twice as far from the eye as the latter is from the edge of the lip; legs shorter, the tibio-tarsal joint not reaching beyond the center of the eye; distance from end of coccyx to end of sacral diapophysis much less than width of head and not more than distance from tip of snout to posterior rim of tympanum; no outer metatarsal tubercle.

Type.—U.S.N.M. No. 34333; Ishigaki shima, Yaeyama group, Riu Kiu Archipelago.

Remarks.—This new form is closely related both to *P. viridis*, from Okinawa shima, and to *P. schlegelii*, from Japan proper. With the former it shares the greater width of the fingers relative to the disks, due to the greater width of the lateral dermal margins, and also the greater distance of the nostrils from the eye, if this indeed is a character to be relied upon, while with the latter it has in common the comparatively shorter hind legs, inasmuch as the tibio-tarsal joint does not reach beyond the center of the eye when the hind leg is stretched forward along the side of the body. Correlated with this character is the relative shortness of the sacrum. In *P. owstoni* the distance from the end of sacral diapophysis to the end of the coccyx, or so-called urostyle, equals the distance from tip of snout to center of tympanum, being much less than the width of the head, while in the specimen of *P. viridis* examined by me that distance is much greater than from tip of snout to posterior rim of tympanum and at least as great as the width of the head. The inner metatarsal tubercle is larger than in *P. viridis*, but an outer tubercle is entirely absent. Most of the specimens have the sides, the anterior and posterior aspects of femur as well as the underside of the tibia, dotted with small roundish spots of a dark purplish brown, but this character, unfortunately, is not without exceptions.

As with *P. viridis* a detailed description is superfluous, but a list of measurements of the type specimen is appended for comparison with the others.

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[a] Named for Alan Owston, esq., of Yokohama, to whom science is indebted for numerous interesting additions to the Japanese fauna.

Dimensions.

	mm.
Total length, tip of snout to vent	65
Width of head	23
Interorbital space	7.5
Upper eyelid	5
Diameter of eye	6.5
Diameter of tympanum	4
Diameter of largest finger disk	5
Fore leg	38
Hind leg, vent to tip of longest toe	90
Tibia	27

Habitat.—Thus far found only on the southern group of the Riu Kius. The United States National Museum has a fine series from Ishigaki shima. The specimen collected by Doctor Warburg, in 1891, in Miyako shima, and now in the Hamburg Museum (No. 534) belongs probably to the present form.

List of specimens of Polypedates owstoni.

U. S. N. M. No.	Sex.	Locality.	When collected.	By whom collected or from whom received.
34330	Adult	Ishigaki shima, Riu Kiu		A. Owston.
34331	....do	....do		Do.
34332	....do	....do		Do.
34333	Female[a]	....do		Do.
34334	Adult	....do		Do.
34335	....do	....do		Do.
34336	Male	....do		Do.
34337	Adult	....do		Do.
34338	....do	....do		Do.
34339	....do	....do		Do.
34340	....do	....do		Do.
34341	....do	....do		Do.
34342	....do	....do		Do.
34343	....do	....do		Do.
34344	....do	....do		Do.
34345	....do	....do		Do.
34346	....do	....do		Do.
34347	....do	....do		Do.
34348	....do	....do		Do.
34349	....do	....do		Do.

[a] Type.

POLYPEDATES BUERGERI[a] (Schlegel).

Plate XII.

1838. *Hyla buergeri* Schlegel, Fauna Japon. Rept., p. 113, Sauri. et Batr., pl. iii, figs. 7–8[b] (type-locality, Japan; types in Leiden Mus.; Buerger, collector).—Schlegel, Abbild. Amph., 1844, p. 140, pl. l, fig. 5 (Japan; colored original sent by Buerger).—BOETTGER, Offenbach. Ver. Naturk. 17–18 Ber., 1878, p. 8 (Japan).—*Polypedates buergeri* DUMÉRIL and BIBRON, Erpét. Gén., VIII, 1841, p. 521 (Japan).—GUENTHER, Cat. Batr. Sal. Brit. Mus., 1858, p. 80 (Japan).—*Rana buergeri* BOULENGER, Cat. Batr. Sal. Brit. Mus., 1882, p. 73 (Japan); Proc. Zool. Soc. London, 1886, p. 412 (Japan).—OKADA, Cat. Vert. Japan, 1891, p. 67 (Hakone, Musashi, Nikko, etc.).—BOETTGER, Kat. Batr. Mus. Senckenberg., 1892, p. 13 (Japan).—KREFFT, Verh. Ges. Deutsch. Naturf. Aerzte, 69 Vers., Braunschw., 1897, II, Pt. 1, 1898, p. 187 (habits).—*Rhacophorus buergeri* BOULENGER, Proc. Zool. Soc. London, 1888, p. 205.

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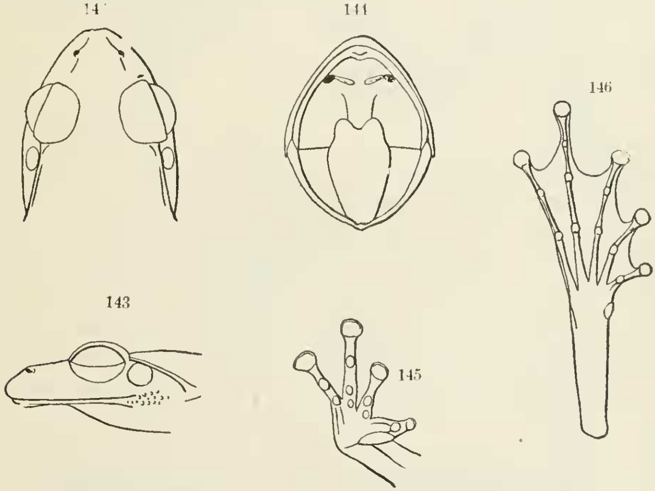
[a] To Doctor Buerger, the companion and successor of von Siebold in the exploration of the fauna of Japan.

[b] Reproduced in this work on Plate XII.

1838. *Buergeria subversicolor* TSCHUDI, Classif. Batr., pp. 34, 75 (Japan; substitute name for *buergeri*).

Description (figs. 142–146).—*Adult female;* U.S.N.M. No. 31904; Kochi, Tosa, Shikoku; May 11, 1903; Dr. H. M. Smith, collector.



FIGS. 142–146.—POLYPEDATES BUERGERI. 1⅓ × NAT. SIZE: 142, TOP OF HEAD; 143, SIDE OF HEAD; 144, OPEN MOUTH; 145, UNDERSIDE OF HAND; 146, UNDERSIDE OF FOOT. NO. 23904, U.S.N.M.

Vomerine teeth in two long, nearly straight series between the choanæ, starting at the inner front corner of the latter, and separated from each other by an interspace less than the length of a series; nostril nearer the tip of snout than the eye; interorbital space about equaling the width of the eye; tympanum about one-half the diameter of the eye; fingers prefectly free; first finger much shorter than second, which falls considerably short of fourth; disks of third and fourth finger large, as large as tympanum, of second and first successively smaller; toes fully webbed; largest disks of toes equaling in size disk of second finger; subarticular tubercles strong; inner metatarsal tubercle small, weak, slightly projecting; no outer tubercle; tibio-tarsal articulations reach center of eye and overlap slightly when hind legs are placed at right angles to axis of body; skin above, including eyelids, snout, sides of face, and upper surface of limbs warty; underside nearly smooth except lower belly and basal portion of posterior aspect of femur granular. Color (in alcohol) above dull brownish gray with obscure dark spots which become sharply defined and blackish on the sides and hind legs; a chevron mark of dusky on the upper eyelids and interorbital space, the convexity pointing backward, and two longitudinal curved lines between the shoulders with their convexity toward the median line; legs crossbarred and marbled with blackish; upper posterior aspect of femur marbled with black; underside whitish, lower lips and adjacent portions of throat, as well as lower portions of the thigh and the tibia, with numerous small black spots.

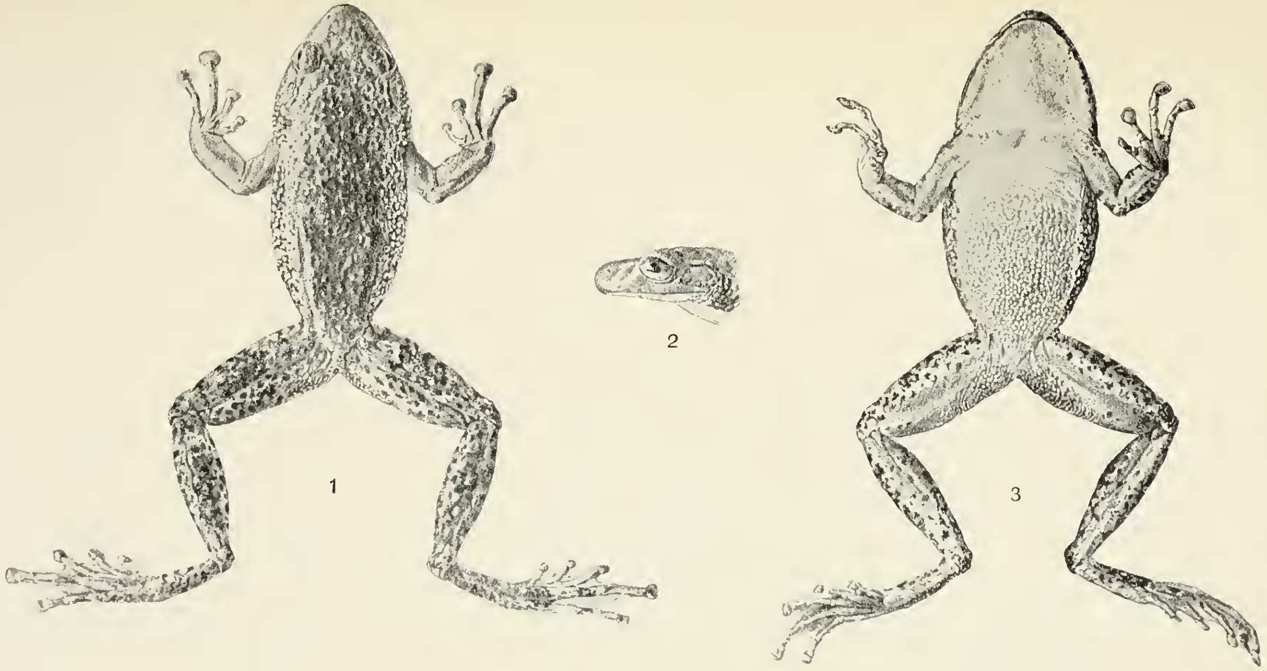
Dimensions.

	mm.
Total length, tip of snout to vent	70
Width of head	24
Fore leg	42
Hind leg, vent to tip of longest toe	115
Tibia	33

The *adult male* is apparently much smaller, U.S.N.M. No. 31906, same locality, date, and collector, measuring only 45 mm. in total length. The hind legs are much longer, as the tibio-tarsal joint reaches the nostril, and the tibia is slightly longer than half the total length, viz. 23.5 mm. There is a large swelling at the base of the first finger, with a pad of copulatory asperities, as in the Ranas, covering the side of the metacarpal and the basal phalanx. There is also an internal vocal sac with an opening in the mouth on either side of the tongue. The coloration is essentially as in the female, only the dusky spots on the throat are much smaller and much more numerous.

Variation.—Our series is rather uniform, showing but little variation, except that there is a great deal of difference in the amount of dark markings on the underside, the above descriptions representing the maximum.

Habitat.—None of the records thus far published, except Okada's Catalogue, gives any definite localities for this strictly Japanese species. The original types collected by Buerger have only "Japan" for habitat, presumably southern Japan, or more strictly Kiusiu. However, in the United States National Museum we have specimens from Miyazaki, in Kiusiu, collected by Rev. C. A. Clark, and from the province of Iga, in Hondo, about 30 miles east of Osaka, through Professor Ijima. Dr. T. Lenz, in 1896, also collected it in the same general region, specimens from the provinces of Yamashiro, Setsu, and Yamato, surrounding Kioto and Osaka, being in the Hamburg Museum (Nos. 1000, 1009, 1011). Osaka, besides recording it from the provinces of Mino, Hida, and Yamashiro, mentions Hayakawa, near Hakone, Chichibu in Musashi, and Yumoto and Chuzenji Lake, at Nikko, as places where Buerger's tree-frog occurs. United States



POLYPEDATES BUERGERI. (FROM SCHLEGEL.)

FOR EXPLANATION OF PLATE SEE PAGE 554.

National Museum also has a large number of specimens from Mount Fuji. Whether this species goes farther north than Nikko I do not know. In Shikoku it has been collected by Dr. H. M. Smith. In the Riu Kius it is replaced by the next species.

List of specimens of Polypedates buergeri.

U.S. N.M. No.	Sex.	Locality.	When collected.	By whom collected.
23904	Male [a]	Province of Iga, Hondo		I. Ijima.
23905	do	do		Do.
30745	Female	Miyazaki, Kiusiu		C. A. Clark.
31904	do. [b]	Kochi, Tosa, Shikoku	May 11, 1903	H. M. Smith.
31905	Male	do	do	Do.
31906	do. [c]	do	do	Do.
34350	do	Mount Fuji, Hondo	May, 1898	A. Owston.
34351	do	do	do	Do.
34352	do	do	do	Do.
34353	do	do	do	Do.
34354	do	do	do	Do.
34355	do	do	do	Do.
34356	do	do	do	Do.
34357	do	do	do	Do.
34358	do	do	do	Do.
34359	do	do	do	Do.
34360	do	do	do	Do.
34361	do	do	do	Do.
34362	do	do	do	Do.
34363	do	do	do	Do.
34364	do	do	do	Do.
34365	do	do	do	Do.
34366	do	do	do	Do.
34367	do	do	do	Do.
34368	do	do	do	Do.
34369	do	do	do	Do.

[a] Figs. 142–146 p. 151. [b] Description, p. 151. [c] Description, p. 152.

POLYPEDATES EIFFINGERI[a] (Boettger).

1860. *Polypedates burgerii* Hallowell, Proc. Phila. Acad., 1860, p. 501 ("Loo Choo Islands") (not of Schlegel).

1895. *Rana eiffingeri* Boettger, Zool. Anz., XVIII, July 8, 1895, p. 267 (type-locality, "either, and probably, from Okinawa, of the middle group, or from Ohoshima, of the northern group;" type, Mus. Senckenberg., No. 1074*a*); Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 104.

As I have no specimen of *P. eiffingeri*, I give below a translation of Doctor Boettger's original description of the type (fig. 147) which, thanks to his courtesy, I had the pleasure of examining in 1898. Like *P. buergeri*, the specimen in question has the first finger much shorter than second and the tibia about one-half the total length of head and body.

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[a] Named for Mr. Georg Eiffinger, of Frankfort on the Main.

Original description of type specimen.—Adult female: Museum Senckenbergianum, No. 1074*a;* Riu Kiu Islands.—Vomerine series between the choanæ, feebly developed, small, oval, separated by a very wide interval; head broader than body, short, very broad; snout short triangular, anteriorly truncated; eye larger and more protruding than in *P. buergeri* (Schlegel); all other characters as in the latter, but the back less warty, a small white tubercle on the tibio-tarsal joint and a series of smaller, isolated white tubercles along the posterior edge of the lower arm and the tarsus, and the posterior legs shorter; the adpressed hind leg reaches with the tibio-tarsal joint to the anterior border of the eye (in *P. buergeri* to the nostril or to the tip of the snout); the digital disks somewhat smaller than the tympanum. Color quite similar, but the posterior aspect of the femur lighter, brownish yellow, with large blackish spots and marblings.

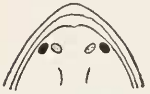

FIG. 147.—POLYPEDATES EIFFINGERI. ABOUT 1⅓ × NAT. SIZE. VOMERINE TEETH. SKETCH BY AUTHOR FROM TYPE IN SENCKENBERG MUSEUM.

Dimensions.

	mm.
Length of head and body	35
Length of head	12.5
Width of head	14
Tympanum	2.25
Fore leg	22
Hind leg	57
Tibia	18
Largest digital disk	2[a]

Habitat.—Thus far only known as occurring in the Riu Kiu Archipelago at large. Hallowell reports *Polypedates burgerii* from "Ousima" and the "Loo Choo Islands," a record probably referable to the present species. The origin of the type is not known exactly, as Mr. Schmacker's Japanese collector visited all three groups in the Riu Kius, but Doctor Boettger regards it as certain that the specimen in question came either from the northern or the middle group, with the probability in favor of the latter.

List of specimens of Polypedates eiffingeri.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected or from whom received.
Senckenberg	1074*a*	Female[a]	Riu Kiu Islands		B. Schmacker.

[a] Type; description, p. 154; fig. 147.

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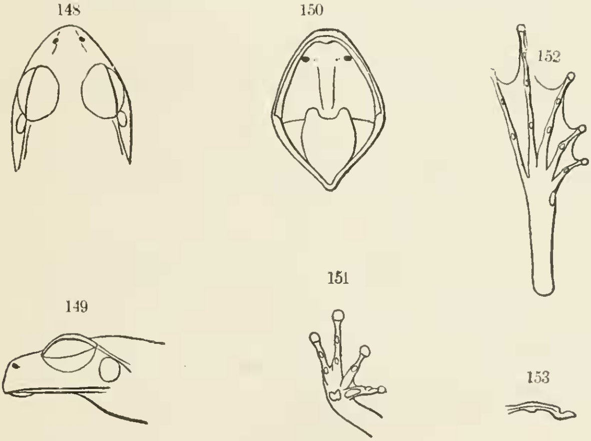
[a] Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 105.

POLYPEDATES JAPONICUS (Hallowell).

1860. *Ixalus japonicus* Hallowell, Proc. Phila. Acad., 1860, p. 501 (type-locality, Oshima, northern Riu Kius; type, U.S.N.M. No. 7313; Stimpson, collector).—Okada, Cat. Vert. Japan, 1891, p. 66 (Okinawa shima).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 865; author's separate, p. 16.

1886. *Rana macropus* Boulenger, Proc. Zool. Soc., London, 1886, p. 414 (substitute name; "Oho shima"); Ann. Mag. Nat. Hist. (6), X, Oct., 1892, p. 302 (Okinawa; Holst, collector).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 865; author's separate, p. 16.—Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 103 ("Ohoshima or Okinawa.")

I have convinced myself by a careful dissection of the fingers of one of Hallowell's cotypes of *Ixalus japonicus* that there is an intercalated bone between the penultimate and the ultimate phalanges, and that this species, therefore, belongs to the genus *Polypedates* and not to *Rana*. This arrangement of the tip of the digits is also quite easily discernible from the outside, the peculiar notch between the disk and the penultimate phalanx being very conspicuous.



Figs. 148–153.—Polypedates japonicus. 1⅓ × nat. size. 148, top of head; 149, side of head; 150, open mouth; 151, underside of hand; 152, underside of foot; 153, tip of digit. No. 7313, U.S.N.M.

The vomerine teeth are so insignificant that at a first inspection they seem to be absent. Under a very powerful lens, however, a transverse series of very minute teeth is discovered close to the anterior border of the choanæ. This justifies the reference of this species to *Polypedates* rather than to *Ixalus*, or *Philautus*[a] Gistel, as the name should stand, *Ixalus* Duméril and Bibron, 1841, being preoccupied by *Ixalus* Ogilby, Proc. Zool. Soc. London, 1836, p. 119.

Description.—Adult female; U.S.N.M. No. 7313 *a;* Amami-o-shima, Riu Kiu; May, 1855; W. Stimpson, collector (figs. 148–153). Vomerine teeth in two oblique, very indistinct series between and very close to the inner border of the choanæ; nostril nearer the tip of snout than the eye; interorbital space narrower than upper eyelid; horizontal diameter of tympanum less than one-half the diameter of the eye; fingers free, first much shorter than second; disks of third fingers largest, less than half the diameter of tympanum; webs of toes excised to distal end of first phalanx of fourth toe; subarticular tubercles not very prominent; inner metatarsal tubercle small, oval; no outer tubercle; tibio-tarsal articulations reach beyond the tip of the snout more than half the width of the head when hind legs are extended forward along the body, and when bent at right angles to the axis of the body the same joints overlap more than the width of the interorbital space; skin above smooth with scattered tubercles, which are more numerous on the sides, and various very narrow and not conspicuous longitudinal folds which anastomose more or less and form two shallow crescents on the shoulders, with the convexity toward the median line; throat and chest smooth; rest of underside of body, as well as posterior aspect of the femur near the base, coarsely granular; a fold from posterior border of eye over tympanum to above insertion of fore leg. Color (in alcohol), above pale drab with brown markings; a chevron mark on top of head across the middle of upper eyelids with the angle pointing backward; on the shoulders two angular marks corresponding to the glandular folds, a dark vertical band from front of eye to edge of lip, and a longitudinal one from eye over upper part of tympanum to shoulder along the lower edge of the glandular fold; legs and feet cross-barred; lower lip with some dark brown spots; a dark brown longitudinal line in front of upper part of overarm; underside otherwise white.

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[a] *Philautus* Gistel, Naturg. Thierr., 1848, p. x (substitute name for *Orchestes* Tschudi, 1838, which is also preoccupied by Illiger, 1807). See Stejneger, Proc. U. S. Nat. Mus., XXVIII, 1905, p. 346.

Dimensions.

	mm.
Total length, tip of snout to vent	33
Width of head	11
Fore leg	19
Hind leg, vent to tip of longest toe	62
Tibia	21

The *adult male* is smaller; U.S.N.M. No. 7313 *d*, same locality, date, and collector, measures only 26 mm.; a copulatory pad of minute asperities forms a swelling on top and side of the metacarpal of first finger; there is apparently an internal vocal sac with openings on both sides of the mouth back of the tongue.

Variation.—In structure and proportions there is very little variation observable. The coloration is also on the whole very uniform, though the extent and intensity of the dark markings vary somewhat; thus there is often a dark line connecting the angles of the scapular marks, and in some there is an elongated lozenge-shaped mark on the lower back.

Habitat.—Although originally recorded by Hallowell as from "Japan," this species is confined to the Riu Kius, for the original label, with the locality "Ousima, Japan," is still in the bottle with Hallowell's types of *Ixalus japonicus.* Boulenger, in referring the species to *Rana,* redescribed and renamed it (as there was already another *Rana japonica*) from a specimen in the British Museum, obtained by Lieut. Alfred Carpenter, R. N., at "Oho Shima," and he has since recorded its occurrence in Okinawa shima.[a] Two specimens in the Science College Museum (Nos. 24 A and (I) P 2) from the latter locality have been examined by me and compared with Hallowell's types.

List of specimens of Polypedates japonicus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.
U.S.N.M	7313 a	Female [a]	Amami-o-shima, Riu Kiu	May, 1855	W. Stimpson.
Do	7313 b	do	do	do	Do.
Do	7313 c	do	do	do	Do.
Do	7313 d	Male [b]	do	do	Do.
Do	7313 e	do	do	do	Do.
Do	7313 f	do	do	do	Do.
Sci. Coll., Tokyo	24 A	Female	Okinawa shima, Riu Kiu		
Do	(I) P 2	do	Naha, Okinawa		Shiraishi.

[a] Type; description, p. 155; figs. 148-153.

[b] Description, p. 156.

POLYPEDATES LEUCOMYSTAX [b] (Gravenhorst).

1829. *Hyla leucomystax* GRAVENHORST, Delic. Mus. Vratislav., p. 26 (type-locality, Java; type in Breslau Mus.; Kuhl, collector).—*Rhacophorus leucomystax* BOULENGER, Proc. Zool. Soc. London, 1889, p. 29 (southern China and eastern Himalayas to Malay peninsula and archipelago).

1829. *Hyla sexvirgata* GRAVENHORST, Delic. Mus. Vratislav., p. 28 (type-locality, Java; type in Breslau Mus.; Reinwardt, collector).

1835. *Hyla quadrilineata* WIEGMANN, Nova Acta Acad. Leop. Carol., XVII, Pt. 1, p. 260, pl. XXII, fig. 1 (type-locality, Manila, P. I.; Meyen, collector).

1841. *Polypedates rugosus* DUMÉRIL and BIBRON, Erpét. Gén., VIII, p. 520 (type-localities, Java and Manila; types in Paris Mus.).

1858. *Polypedates maculatus* GUENTHER, Cat. Batr. Sal. Brit. Mus., p. 78 (part: China; Philippines).

1860. *Polypedates megacephalus* HALLOWELL, Proc. Phila. Acad., 1860, p. 507 (type-locality, Hongkong).

1882. *Rhacophorus maculatus* var. *quadrilineata* BOULENGER, Cat. Batr. Sal. Brit. Mus., p. 84 (Singapore, Java, Philippines, Formosa).

1885. *Hylorana longipes* FISCHER, Archiv Naturg., LI, Pt. 1, p. 47 (type-locality, Pagat, southeast Borneo; type in Brit. Mus.; Grabowsky, collector).

1889. *Rhacophorus leucomystax* var. *sexvirgata* BOULENGER, Proc. Zool. Soc. London, 1889, p. 30.

Description.—Adult female; Brit. Mus. No. 79.6.20.27; Formosa; Matthew Dickson, collector. Vomerine teeth in two nearly straight rows between the choanæ, contiguous with the latter and separated from each other by a space as wide as the choanæ; nostrils nearer tip of snout than eyes; upper eyelids only two-thirds the interorbital space; diameter of tympanum about three-fourths that of the eye; fingers with barely a rudiment of web; first finger shorter than second by half the diameter of the disk, which is more than half that of the tympanum; toes about half webbed, inner metatarsal tubercle much smaller than digital disks; no outer tubercle; tibio-tarsal joint extends beyond the tip of the snout; skin nearly smooth above and on throat and chest, strongly granular on belly and underside of thighs; a sharp, narrow fold from posterior corner of eye in a straight line over tympanum, ending rather abruptly some distance past the insertion of the fore limb. Color (in alcohol), pale brownish gray above, with four obscure longitudinal brownish bands, the lateral ones broader and originating on the anterior portion of the upper eyelids, the median ones narrower, originating on the snout and apparently confluent on the sacrum; a narrow blackish line runs from the tip of snout through the nostrils, middle of eyes, and over the tympanum just underneath the postocular fold; on the flanks a few distinct blackish reticulations; edge of jaws whitish, accentuated by a very narrow line of dark brownish.

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[a] Proc. Zool. Soc. London, 1892, p. 302.

[b] From λευκός, bright, white; μύσταξ, upper lip.

Dimensions.

	mm.
Total length, tip of snout to vent	58
Snout to eye	11
Snout to posterior border of tympanum	22
Nostril to eye	8
Diameter of eye	7
Diameter of tympanum	5
Interorbital width	7
Fore leg	36
Tibia	32
Digital disks	2.75

Habitat.—*Polypedates leucomystax* is said to inhabit "Southern China and Eastern Himalayas to the Malay peninsula and archipelago." The striped form, supposed to be only a color variety,[a] has been found in Java, Sumatra, Singapore, the Philippines, and in Formosa, a specimen from the latter island, collected by Mr. Matthew Dickson, being in the British Museum.

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[a] Mr. S. S. Flower, who studied *Polypedates leucomystax* alive in the Malay peninsula, says that the striped specimens do not represent "even a true variety, as the dark lines appear conspicuously and disappear entirely in the same individual. If killed with or without the lines visible they remain so in spirit. In Singapore at different times I noticed many young frogs which had just left the water, all of which had the dark lines visible; these disappear as the animal grows, only to reappear temporarily in the adult." (Proc. Zool. Soc. London, 1896, p, 906.)

List of specimens of Polypedates leucomystax.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.
Brit. Mus	79.6.20.27	Female[a]	Formosa		M. Dickson.

[a] Description, p. 157.

TADPOLES.

The characters of the larvæ of the tailless batrachians of Japan and adjoining territory have received no attention thus far. Boulenger has given the study of the European forms special attention, and Flower has described several eastern Asiatic species. From Boulenger's key to the European tadpoles[a] and Flower's descriptions it is possible to draw up a general scheme of the Japanese forms, by which at least the genera may be recognized. Upon this basis it will then be comparatively easy for the resident naturalists to gradually extend the key to include all the species.

It will be necessary for this purpose to give a brief account of the morphological characters which are utilized for the distinction of these larvæ. The following is therefore condensed from Boulenger's excellent chapter on the tadpoles in the work alluded to above.

Tadpoles for identification are preferably selected after the budding of the hind legs and before the appearance of the front legs.

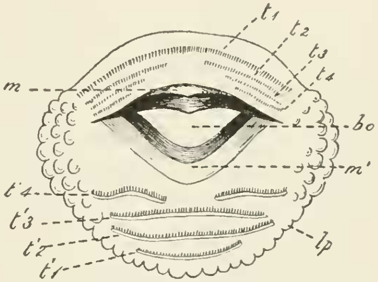

Fig. 154. Open mouth of tadpole of Rana temporaria. 15 × nat. size. *bo*, buccal orifice; *lp*, labial papillæ; *m*, upper, *m'* lower mandible; *t*, series of teeth on upper lip; *t'*, series of teeth on lower lip. (Adapted from Proc. Zool. Soc. London, 1891, pl. XLV, fig. 3a.)

By *body* is meant head and body together, and its longitudinal measurement is taken to the origin of the hind limbs. Depth of tail includes crests.

By *mouth* (fig. 154) is understood the opening with its horny beak, not unlike that of a cuttlefish, as well as the surrounding, funnel-shaped lip. This may be entirely bordered by fleshy papillæ, or these may be restricted to the sides, or to the sides and the lower border. The inner surface of the lip is furnished with ridges armed with series of minute, bristle-like, erect, horny teeth. By drawing an imaginary line across the mandibles, the lip may be divided into an upper and a lower portion, the series of teeth above the upper mandible being termed *upper labial*, those below the lower mandible being *lower labial.* These are described as first, second, third, etc., proceeding from the outer border toward the beak in both the upper and lower sections of the lip. The first series, either in the upper or lower section, may be marginal or may be within the border, which is then occupied by fleshy papillæ. The arrangement of the series is expressed by a formula: $\frac{2}{3}$, for instance, indicating the number in the upper and lower sections, the line corresponding to the beak.

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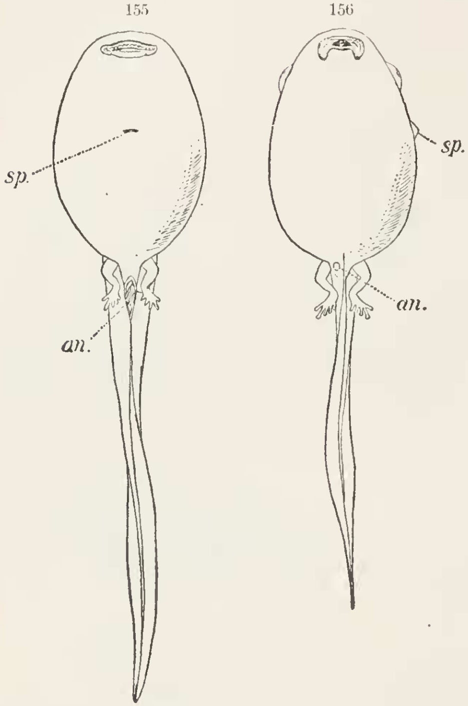
[a] Taill. Batr. Europe, pp. 105–109.

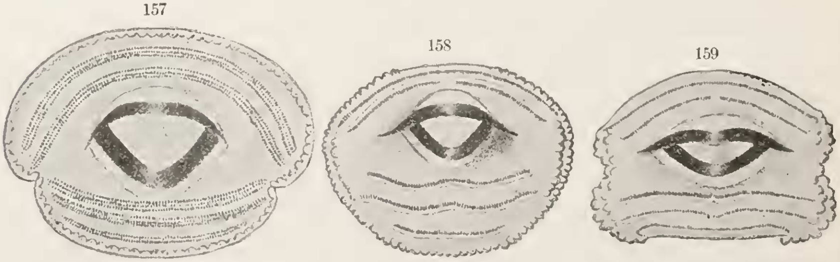


Figs. 155–156.—Lower view of tadpoles, showing location of spiraculum and anal opening. 155, Discoglossoid (costate) toad; 156, Hyla. *sp*, spiraculum; *an*, anus. (From Boulenger, Proc. Zool. Soc. London, 1891, p. 596.)

By *spiraculum* (figs. 155–156) is understood the opening or tube by which the water is expelled from the bronchial chambers. In our species it is located either on the left side or in the median line on the breast.

The *anal* opening (figs. 155–156) is also a tube situated at the beginning of the tail either in the middle line or laterally beside the origin of the lower caudal crest.

The openings of numerous *sensory ducts* form more or less complicated systems of lines on head and body, and are of some systematic value. A glandular streak extending from the nostril toward the eye is the *lachrymal canal.*



Figs. 157–159.—Mouth of tadpoles. 10 × nat. size. 157, Bombina salsa; 158, Hyla arborea. 15 × nat. size. 159, Bufo bufo. (From Boulenger, Proc. Zool. Soc. London, 1891, pl. xlvii, fig. 5a; pl. xlvi, figs. 1a and 4a.)

PRELIMINARY KEY TO THE TADPOLES.

a^1 Mouth with horny beak; series of horny teeth, more or less surrounded by papillæ.

b^1 Spiraculum in the mid-ventral line (fig. 155); labial teeth in two or more rows in nearly every series .... *Bombina* (*bombina*, *salsa*, fig. 157)

b^2 Spiraculum on the left side of the body (fig. 156); labial teeth in one row in each series.

c^1 Anus median (fig. 155); spiraculum directed backward; lower lip only papillose at the corners.

Bufo (*bufo*, fig. 159; *viridis*; *calamita*; *melanostictus* [Flower, Proc. Zool. Soc., 1896, pl. XLIV, fig. 3])

c^2 Anus dextral, fig. 156; spiraculum directed backward and upward; papilla continuous along lower lip or only narrowly interrupted in the middle.

d^1 Anus opening above the lower edge of the tail; upper caudal crest extending far forward on the back almost to between the eyes . *Hyla* (*arborea*. fig. 158)

d^2 Anus opening close to the lower edge of the tail; upper caudal crest not extending forward beyond the vertical of the spiraculum.

e^1 Papillose series bordering lower lip uninterrupted in the middle. . *Rana*.

f^1 Upper lip not bordered by papillæ; beak white, more or less broadly bordered with black.

g^1 Series of labial teeth $\frac{2 \text{ or } 3}{3}$

R. macrodon [Flower P. Z. S., 1899, pl. LIX, fig. 1]; *esculenta; arvalis*.

g^2 Series of labial teeth $\frac{3 \text{ to } 5}{4}$ .... *R. temporaria*, fig. 154; *agilis*.

f^2 Upper lip bordered by papillæ like lower one; beak entirely black.

R. tigerina [Flower, P. Z. S., 1899, pl. LIX, fig. 2]

e^2 Papillose border of lower lip narrowly interrupted in the middle.

Polypedates leucomystax [Flower, P. Z. S., 1896, pl. XLIV. fig. 2; 1899, pl. LIX, fig. 3]

a^2 Mouth without hard beak, labial teeth, or papillæ, consisting of a simple upper lip and a contractile lower one...... *Microhyla ornata* [Flower P. Z. S., 1899, pl. LX, fig. 1]

Class REPTILIA.

1768. *Reptilia* LAURENTI, Synops. Rept., p. 19 (compare p. 6).
1820. *Pholidota* MERREM, Tent. Syst. Amph., p. 5.
1826. *Monopnoa* FITZINGER, Neue Classif. Rept., p. 3.
1841. *Haplopnoa* LEUCKART, Zool. Bruchst., II, p. 31.

The existing reptiles are divided by Dr. H. F. Osborn into two subclasses, *Diapsida* and *Synapsida*. To the latter belongs only one existing order, viz, the turtles (*Testudinata*), which are characterized by having the scapular arch internal to the ribs, while in the three existing orders of the *Diapsida* it is external. These orders are: *Crocodilini* (also called *Loricata* or *Emydosauria*), characterized by two-headed ribs; *Rhynchocephalia*, represented by a single surviving genus in New Zealand (*Sphenodon*), superficially resembling a lizard, but distinguished from the next order by having, among other characters, the quadrate bone immovably fixed to the adjacent cranial elements by suture, while in the *Squamata*, embracing snakes and lizards, it is loosely articulated with the cranium at the proximal end; the last two orders have one-headed ribs.

As stated, recent *Rhynchocephalia* occur only in New Zealand, and the crocodiles are not known with certainty to enter our territory, in which consequently only the *Squamata* and the *Testudinata* are found. These two orders are always easily distinguished by their external appearance alone, the solid encasement of the turtles in their bony shell, covered by horny plates or a soft skin, being a character quite sufficient. Moreover, the presence of teeth in the squamate order contrasts easily with the toothless horn-sheathed jaws of the turtles.

Subclass DIAPSIDA.

1903. *Diapsida* H. F. Osborn, Science (n. s.), XVII, Feb. 10, 1903, p. 276.

Order SQUAMATA.

1811. *Squamata* Oppel, Ordn. Rept., p. 14.
1825. *Squamosa* Latreille, Fam. Nat. Règne Anim., p. 93.
1831. *Ophidosaurii* Eichwald, Zool. Specialis, III, p. 168.
1854. *Streptostylica* Stannius, Handb. Zootom., II, Wirbelth., Pt. 2, Amph., p. 5.
1866. *Lepidosauria* Haeckel, Gen. Morphol., II, p. cxxxvi.
1898. *Sauria* Gadow, Classif. Vertebr., p. 24.

Besides the chameleons, which form a suborder by themselves (*Prendentia*, or *Rhiptoglossi*), but do not occur east of India, the order *Squamata* consists of two suborders—the lizards (*Sauria*) and the snakes (*Serpentes*). The anatomatical characters which distinguish them consist chiefly in the separate condition of the rami of the lower jaw in the snakes, while they are solidly united in the lizards; in the total absence even of vestiges of a pectoral arch in the snakes; and in the closing of the brain case anteriorly in the latter. There are no external characters which will in all cases separate a snake from a limbless lizard, except that in the latter the tongue is not retractile into a basal sheath, while in most cases they possess distinct eyelids and ear-openings, both wanting in the snakes. All the lizards within the region here treated of have four limbs and are thus easily distinguished from the snakes.

Suborder SAURIA.

1788. *Lacertæ* Batsch, Anleit. Kenntn. Thiere Mineral., I (p. 437).
1802. *Sauria* Macartney, in Ross' Transl. Cuvier's Lect. Comp. Anat., I, tab. iii.
1803. *Sauri* Daudin, Hist. Nat. Rept., V, tabl., p. 8.
1804. *Saurii* Latreille, Nouv. Dict. d'Hist. Nat., XXIV, tabl. méth., p. 61.
1828. *Pneumaturomolgaci* Ritgen, Nova Acta Acad. Leop. Carol., XIV, p. 274.
1828. *Sauræ* Wagler, Isis, 1828, p. 860.
1831. *Lacertina* Mueller, Tiedem. et Trevir. Zeitschr. Phys., IV, p. —.

1839. *Saures* SWAINSON, Nat. Hist. Class. Fish. Amph. Rept., II (Lardner's Cab. Encycl.), p. 148.
1842. *Lacertilia* OWEN, Rep. Brit. Ass. Adv. Sci. Plymouth Meet., 1841 (p. 144).
1845. *Saura* GRAY, Cat. Liz. Brit. Mus., p. 3.
1849. *Porpopoda* MAYER, Rheinlaend. und Westphal. Verhandl., VI (p. 177).
1857. *Lepidota* JAN, Cenni Mus. Milano, p. 37.
1886. *Englossa* GILL, Rep. Smithson. Inst., 1885, p. 801.
1898. *Autosauri* HAECKEL, in Gadow, Classif. Vertebr., 1898, p. 24.

The saurian fauna of Japan is very fragmentary, containing at most 30 species belonging to only 4 families. It is very suggestive that the bulk of this number belongs to the two families *Gekkonidæ* and *Scincidæ*, which are nearly cosmopolitan in their distribution. Members of these families, moreover, seem to be more easily transported to distant islands than almost any other lizards. Thus, among the species occurring in Japanese territory, *Hemidactylus frenatus* occurs throughout the islands and along the shores of the western Pacific, from Korea to Australia, the entire Indian Ocean, and even in St. Helena, in the Atlantic Ocean, while the *Cryptoblepharus pœcilopleurus* has a distribution even more extended. The most remarkable range, however, is that of *Leiolopisma laterale*, which furnishes one of the most extraordinary instances of disconnected distribution, as the specimens of the East Asiatic colony seem to be practically indistinguishable from those occurring in North America east of the Rocky Mountains.

The herpetological fauna of Formosa is as yet too little known to allow us to make any generalization as to the route by which the Indo-Malayan species have reached the Riu Kiu Islands

Of the rather numerous superfamilies into which the lizards may be divided, only three are represented in Japan and neighboring countries, viz, the *Gekkonoideæ*, the *Agamoideæ*, and the *Lacertoideæ*, the first two with one family each, the latter with two, the *Lacertidæ* and the *Scincidæ*. Some of their main characters are included in the following:

TABLE OF SAURIAN FAMILIES IN JAPAN, ETC.

a^1 Tongue smooth, or with villose papillæ.
  b^1 (GEKKONOIDEÆ). No postorbital or postfronto-squamosal arches; clavicle dilated proximally .... GEKKONIDÆ, p. 164
  b^2 (AGAMOIDEÆ). Postorbital and postfronto-squamosal arches present; clavicle not dilated proximally .... AGAMIDÆ, p. 182
a^2 (LACERTOIDEÆ). Tongue covered with imbricate scale-like papillæ or with oblique papillose folds.
  b^1 Premaxillary double; body with osteodermal plates .... SCINCIDÆ, p. 193
  b^2 Premaxillary single; no osteodermal plates.................. LACERTIDÆ, p. 228

Taking cognizance of external, easily verified characters only, the species occurring within our area may be referred to their respective families by the following:

ARTIFICIAL KEY TO THE FAMILIES OF LIZARDS OCCURRING IN JAPAN AND ADJACENT TERRITORY.[a]

a¹ No large symmetrical shields on top of head.
  b¹ Digits dilated; no movable eyelids; tympanum exposed .....GEKKONIDÆ, p. 164
  b² Digits compressed; movable eyelids; tympanum concealed ...AGAMIDÆ, p. 182
a² Top of head with large symmetrical shields.
  b¹ Ventral scales cycloid, arranged quincuncially.................SCINCIDÆ, p. 193
  b² Ventral scales squarish, in longitudinal and transverse series...LACERTIDÆ, p. 228

Family GEKKONIDÆ.

The Geckos are lizards with smooth or papillose tongue, dilated clavicles and biconcave vertebræ; mostly without movable eyelids and with vertical pupil; toes variously modified or dilated into more or less adhesive organs.

A large family they are represented in all the hotter portions of the globe, but are most numerous in the Indian and Australian regions. In the area covered by this work only four or five genera have been found. Owing to the ease with which the geckos may be accidentally transported from place to place, they are often introduced unintentionally into new localities by human agency.

Probably most of the species are nocturnal, and owing to the construction of the toes are enabled to run with ease on smooth perpendicular surfaces. Some species emit a chuckling sound resembling the word "gecko," hence their name. They lay round eggs with a hard, white shell.

Swinhoe has given a spirited account of the habits of the common Japanese house gecko as observed by him in Formosa, which deserves to be reproduced here.[b]

> In running over the perpendicular face of the wall they keep so close and their movements are made so quickly with one leg in advance of the other that they have the appearance at a distance of gliding rather than running. The tail is somewhat writhed as the body is jerked along, and much so when the animal is alarmed and doing its utmost to escape; but its progress even then is in short runs, stopping at intervals and raising the head to look about it. If a fly perch on the wall it cautiously approaches to within a short distance, then suddenly darts forward, and with its quickly protruded glutinous tongue fixes it. Apart from watching its curious maneuvers after its insect food, the attention of the most listless would be attracted by the singular series of loud notes these creatures utter at all hours of the day and night, more especially during cloudy and rainy weather. These notes resemble the syllables "chuck-chuck" several times repeated, and, from their more frequent occurrence during July and August, are, I think, the call notes of the male to the female. During the greater part of the day the little creature lies quiescent in some cranny among the beams of the roof or in the wall of the house where, however, it is ever watchful for the incautious fly that approaches its den, upon whom it darts forth

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[a] For nomenclature of head-shields of lizards, see p. 194, figs. 176–178.

[b] Swinhoe, Ann. Mag. Nat. Hist. (3), XII, 1863, pp. 222–223.

with but little notice. But it is by no means confined to the habitations of men. Every old wall and almost every tree possesses a tenant or two of this species. It is excessively lively, and even when found quietly ensconced in a hole, generally manages to escape—its glittering little eyes (black, with yellow ocher iris) appearing to know no sleep; and an attempt to capture the runaway seldom results in more than the seizure of an animated tail, wrenched off with a jerk by the little fellow as it slips away, without loss of blood. The younger individuals are much darker than the larger and older animals, which are sometimes almost albinos. * * *

I have found the eggs of this gecko in holes in walls or among mortar rubbish. They usually lie several together, are round, and did not seem to me to offer any appearance other than those of ordinary lizards. The young, when first hatched, keep much to themselves under stones in dark cellars, where they live until they attain two-thirds the size of the adults. At this stage they begin to show out in conspicuous places, but always evince alarm at the approach of their older brethren; for what reason, I could not make out.

KEY TO THE GENERA OF GEKKONIDÆ INHABITING JAPAN AND ADJACENT TERRITORY.

a^1 Infradigital plates in a single series; the free distal joint at the extremity of the digital expansion.

- b^1 Digits with but a slight rudiment of web at base; no lateral parachute-like expansion .... *Gekko*, p. 165
- b^2 Digits entirely webbed; wide lateral parachute-like dermal expansion to body, limbs, and tail .... *Ptychozoon*, p. 170

a^2 Infradigital plates in a double series, the distal joint rising from within the extremity of the digital expansion.

- b^1 Inner digit with a compressed clawed phalanx.
  - c^1 Digits free; body without lateral dermal expansion ...... *Hemidactylus*, p. 172
  - c^2 Digits half webbed; body with a much developed lateral dermal expansion. *Cosymbotus*, p. 178
- b^2 Inner digit clawless .... *Peropus*, p. 180

Genus GEKKO[a] Laurenti.

1768. *Gekko* Laurenti, Synops. Rept., p. 43 (type, *G. verticillatus*).
1800. *Gecko* Cuvier, Leçons d'Anat. Comp., I, tabl. III (emendation).
1810. *Gecus* Rafinesque, Caratteri, p. 9 (emendation).
1826. *Platydactylus* Fitzinger, Neue Classif. Rept., p. 13 (same type) (not of Oken 1817).
1833. *Lomatodactylus* van der Hoeven, Handb. Dierk., II, Pt. 2, p. 342 (type, *L. vittatus*).
1843. *Scelotretus* Fitzinger, Syst. Rept., p. 101 (type, *G. vittatus*).

GEKKO JAPONICUS (Duméril and Bibron).

YAMORI.

Plate XIII.

1836. *Platydactylus japonicus* Duméril and Bibron, Erpét. Gén., III, p. 337 (type-locality, Japan; types in Paris Mus.).—Duméril, Cat. Méth. Rept. Mus. Paris, I, 1851, p. 37.—*Gecko japonicus* Guenther, Rept. Brit. India, 1864, p. 103 (southern Japan; Chusan, China; Formosa).—Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 113.—Boulenger, Cat.

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[a] A name derived from the sound made by several species.

Liz. Brit. Mus., I, 1885, p. 188 (Japan; Kiukiang Mts., Chefu, Shanghai, Szechuen, Ningpo, Hongkong, China; Formosa).—Okada, Cat. Vert. Jap., 1891, p. 71 (Tokyo; Chukuzen, etc., Okinawa).—Boettger, Kat. Rept. Mus. Senckenberg., I, 1893, p. 34 (Japan; Hongkong, Canton, Shanghai, Prov. Guan-dung, China).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 860; author's separate, p. 11 (Tokyo; Okinawa).—*Gekko japonicus* Stejneger, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 218 (Taipa, Formosa).

1838. *Platydactylus jamori* Temminck and Schlegel, Fauna Japon., Rept., p. 103 (type-locality, southern Japan; types in Leiden Mus.; Siebold, collector).—Bleeker, Natuurk. Tijdschr. Nederland. Indië, XVI, 1858, p. 204 (name only).—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, pp. 109, 112 (Nagasaki).—*Gecko* (*Platydactylus*) *jamori* Temminck and Schlegel, Fauna Japon., Rept., 1838, pp. 136, 139, Saur. Batr., pl. II, figs. 1–4.[a]

1842. *Gecko chinensis* Gray, Zool. Misc., p. 57 (type-locality, China; type in Brit. Mus.; J. Reeves, collector).—*Platydactylus chinensis* Martens, Preuss. Exped. Ost-Asien, Zool., I, 1876, p. 374 (Nagasaki).

1842. *Hemidactylus nanus* Cantor, Ann. Mag. Nat. Hist., IX, Aug. 1842, p. 482 (type-locality, Chusan, China; types in Brit. Mus.; Cantor, collector).

1863. *Gecko swinhonis* Swinhoe, Ann. Mag. Nat. Hist. (3), XII, p. 222 (Taiwan fu, Formosa; habits) (*nomen nudum*, not of Guenther 1864).

1891. *Platydactylus yamori* Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, p. 239 (Tokyo; not in Yezo).

1902. *Gehyra intermedia* Brown, Proc. Phila. Acad., 1902, June 11, p. 183 (type-locality, probably Okinawa shima; type in Wistar Inst. Phila. No. 572, orig. No. 46; Furness and Hiller, collectors).

The specimens from Tsushima and Fusan, Korea, are identical with the Japanese specimens, showing no tendency toward *Gekko swinhonis*[b] from Northern China. The latter differs in having very few dorsal tubercles, median pair of chin-shields smaller, and scarcely any trace of web between the toes.

Description (figs. 160–163).—*Adult male;* U.S.N.M. No. 31821; Yamagawa, Province of Satsuma, Kiusiu; June 14, 1903; Hugh M. Smith, collector.—Rostral squarish, about twice as wide as high, bounded above by two large internasals and two small scales between the latter, the superior angles entering the nostrils; nostril between first supralabial, rostral, large internasal, and three smaller shields above and behind; distance between nostril and eye equals distance between eye and ear-opening; diameter of eye a little more

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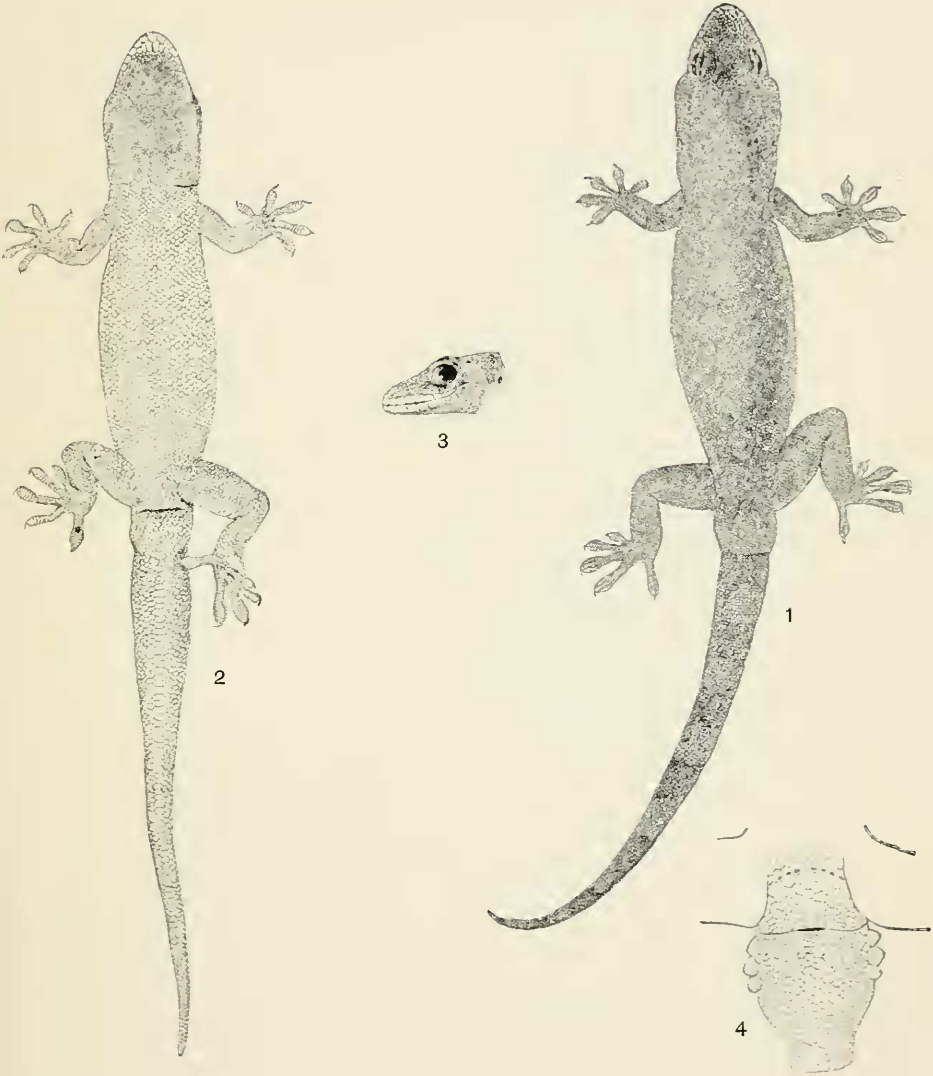
[a] Reproduced in this work on Plate XIII.

[b] 1864. *Gecko swinhonis* Guenther, Rept. Brit. India, p. 104, pl. XII, fig. *A* (type-locality, Peking; type in Brit. Mus.; Swinhoe, collector).—Boulenger, Cat. Liz. Brit. Mus., I, 1885, p. 189 (Peking).—Mueller, Verh. Naturf. Ges. Basel, VII, Pt. 3, 1885 (Tien-tsin).

1877. *Gecko japonicus* Moellendorff, Journ. N. China, Br. R. Asiat. Soc. (n. s.), XI, p. 104 (Prov. Chili, China) (not of Duméril and Bibron).—Méhely, Zichy's Dritte Asiat. Forschungsr., II, 1901, p. 44, pl. VI, figs. 1–2 (Peking).

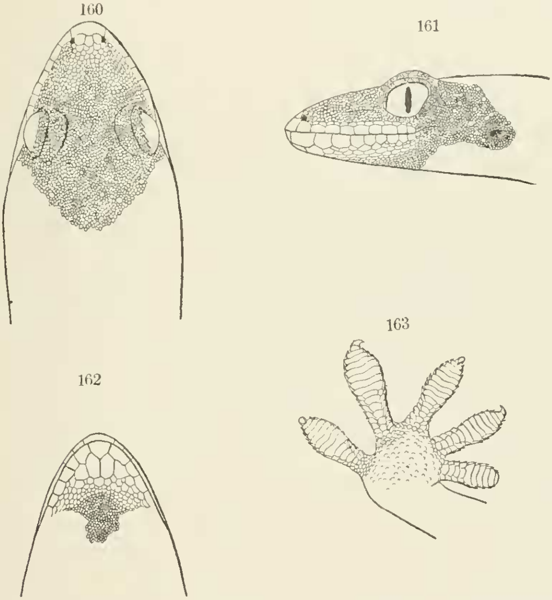
1885. *Gecko swinhoei* Boettger, Offenbach. Ver. Naturk. 24–25 Ber., p. 139; 26–28 Ber. 1888, p. 61 (Miau-feng-shan, near Peking); Kat. Rept. Mus. Senckenberg., I, 1893, p. 35.



GEKKO JAPONICUS. (FROM SCHLEGEL)

FOR EXPLANATION OF PLATE SEE PAGE 554.

than half the distance between eye and tip of snout; ear-opening small, oval, less than one-half the diameter of the eye; eleven upper labials; mental pentagonal, scarcely larger than the adjacent lower labials; nine lower labials; behind mental a pair of median, somewhat elongated chin-shields, on either side of which another similar shield of about the same size; behind these several polygonal smaller shields; whole upper surface covered with granules, those on the snout considerably larger; among the granules, from the eyes backward to the root of the tail, numerous small, rounded tubercles, their mutual distance averaging about one-half the diameter of the eye, not arranged in regular longitudinal series, though about twelve tubercles can be counted in a line across the back; upper surface of limbs covered with granules like the back; lower surface of body and limbs covered with imbricate scales except on the throat and anterior portion of neck, which are covered with granules of the size of those on the back; first toe with 9 lamellæ, fourth with 15 underneath; second, third, and fourth toes connected by a basal web; an angular series of six preanal pores (by an anomaly two inner pores on left side not developed); base of tail swollen, with a single large tubercular scale on each side; tail suddenly tapering from the basal swelling, slightly depressed, oval in section, covered above with small scales, the annular arrangement of which is chiefly marked by the straight posterior outline of every ninth row, and a pair of median tubercles



Figs. 160–163.—Gekko japonicus. 2 × nat. size. 160, top of head; 161, side of head; 162, chin; 163, underside of foot. No. 17521, U.S.N.M.

on the latter; underneath scales larger with a median series of wide plates, every third of which is a little wider, its posterior edge corresponding to the posterior outline of the annulus. Color (in alcohol) drab gray above with a double series of obscure dusky spots on back and crossbars on limbs and tail; an obscure dusky band from nostril through eye to occiput meeting its fellow from the other side on the latter; a similar band from eye to ear-opening, and ill-defined dusky spots on both upper and lower labials.

Dimensions.

	mm.
Total length	106
Snout to vent	60
Vent to tip of tail	46
Snout to ear-opening	16
Greatest width of head	13
Fore leg, from axilla	18
Hind leg, from groin	26

The *adult female* (U.S.N.M. No. 31822; same locality and collector) differs chiefly in the absence of the preanal pores and of the basal swelling of the tail; the spur-like tubercle on each side of the base of the latter is present, but is smaller than in the male; the tail itself is slightly broader and more depressed.

Variation.—Besides slight differences in the number of labials, in the relative size and shape of the chin-shields, and in the number of tubercles on the occiput, it may be mentioned that some specimens, for instance, U.S.N.M. No. 13563, from Nagasaki, have plainly developed tubercles among the granules on the upper side of forearm and tibia, especially on the latter. The number of preanal pores in the males varies somewhat. In some specimens the series is narrowly interrupted on the middle line by a single poreless scale, in others the series is continuous. Thus, No. 13563, from Nagasaki, and No. 13751, from Yokohama, have three pores on each side of the median line; Sci. Coll. No. 30, from Formosa, has 9 pores in a continuous line; No. 14866, from Osaka, has 7 altogether, like a specimen from Shikoku, No. 31895.[a] The spur-like tubercle on each side of the base is very variable. Often there is a group of three large tubercles, and in No. 13563 these are supplemented by two additional large scales at their base.

When the tail is broken off, the new tail grown, as in No. 13563, approximates the old one in size and shape, but the scales are larger somewhat imbricate, and not arranged in transverse series; neither is there any trace of annuli nor of tubercles; a few of the scales on the under side are widened, but there is no median series of regular shields.

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[a] Boulenger's statement (Cat. Liz. Brit. Mus., I, 1885, p. 188), that there are "six to sixteen on each side" is due to a lapse.

Habitat.—The center of its distribution seems to be south-central and eastern China. On the coast it occurs from Hongkong to Chefu. To the north it is replaced by *G. swinhonis*. Outside of China it is found in Formosa, the Riu Kius, Korea, Tsushima, and southern Japan.

In Formosa it is said to be "common everywhere," though the only localities from which specimens have been recorded are Taipa and Taiwan fu. Doctor Fritze reports it equally common in Okinawa. I have before me specimens from Miyako shima, Tsushima, and from Fusan, Korea, collected by Jouy. They are probably a recent introduction in the latter place.

In Japan proper it occurs at least as far north as Tokyo, and specimens from Yokohama, Nagasaki, and Osaka are in the various museums, while Okada enumerates it from the province of Kawachi, Suwo, and Nagato, in Hondo, and Chikuzen, in Kiusiu. Dr. Hugh M. Smith collected it in Satsuma and Shikoku. It does not seem to be found in the mountain districts, and Fritze specifically denies its occurrence in Yezo. Doctor Nozawa writes me that he has "heard of its presence in south Yezo," but if specimens have been taken there they have probably only been introduced in cargoes from farther south. In this connection I may cite Mr. E. Klocke's experience, who once observed a *Gekko* on the walls of a hut in the Chitose forests near Lake Shikotko, which he suggests might have been unintentionally introduced from Hondo.[a]

List of specimens of Gekko japonicus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	13563	Male	Nagasaki	May —, 1881	Jouy and Dale.
Do	13751	do.[a]	Yokohama (?)		P. L. Jouy
Do	14866	([a])	Osaka		R. Hitchcock.
Do	17513		Fusan, Korea	1885	P. L. Jouy.
Do	17514		do	1885	Do.
Do	17515		do	1885	Do.
Do	17521	Female[b]	Tsushima	May —, 1885	Do.
Do	21362	Young	Fusan, Korea	May 28, 1886	Do.
Do	31821	Male[c]	Yamagawa, Kiusiu	June 14, 1903	H. M. Smith.
Do	31822	Female[a]	do	do	Do.
Do	31895	Male[a]	Kochi, Shikoku	May 11, 1903	Do.
Do	31896	Young	do	do	Do.
Do	34186	do	Kanagawa, Yokohama	Dec. 14, 1898	A. Owston.
Do	34187	do	do	do	Do.
Do	34189	Female	do	May 14, 1902	Do.
Do	34190	do	do	do	Do.
Do	36528	Male	Miyakoshima, Riu Kiu		
Sci. Coll. Tokyo	30	do	Taipa, Formosa	Sept. —, 1896	T. Tada.
Wistar Inst	572	([d])	Riu Kiu		Furness and Hiller

[a] P. 168. [b] Figs. 160–163. [c] Description, p. 166. [d] Type of *Gehyra intermedia*.

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[a] Annot. Zool. Japon., V., Pt. 2, 1904, p. 85.

Genus PTYCHOZOON[a] Kuhl.

1822. *Ptychozoon* KUHL, Isis, 1822, p. 475 (*nomen nudum*).
1826. *Ptychozoon* FITZINGER, Neue Classif. Rept., p. 13 (type, *P. homalocephalum*).
1827. *Pteropleura* GRAY, Philos. Mag. (2), II, p. 56 (type, *P. horsfieldii*).
1893. *Ptychozoum* BOETTGER, Kat. Rept. Mus. Senckenberg., I, p. 35 (emendation).

There are two species of *Ptychozoon*, namely, *P. kuhli*[b] and *P. horsfieldii*, which differ considerably. The more essential characters consist in the absence of enlarged tubercles among the dorsal granules in *P. horsfieldii*, the shorter series of preanal pores and the presence of a distinct series of femoral pores in the males of this species. Also in the much feebler segmentation of the tail, as well as the much smaller development of the caudal lobes, which do not join to form a terminal large flap as in *P. kuhli*.

PTYCHOZOON HORSFIELDII[c] (Gray).

1827. *Pteropleura horsfieldii* GRAY, Philos. Mag. (2), II, July, 1827, p. 56 (type-locality, India: Singapore; type in Brit. Mus.; Hardwicke, collector).—*Platydactylus horsfieldii* FITZINGER, Syst. Rept., 1843, p. 101.—*Ptychozoon horsfieldii* MUELLER, Verh. Naturf. Ges. Basel, X, 1892, p. 209, pl. IV (Penang).
1845. *Ptychozoon homalocephala* GRAY, Cat. Liz. Brit. Mus., p. 164 (part: Singapore) (not of Creveld).—*P. homalocephalum* BOULENGER, Cat. Liz. Brit. Mus., I, 1885, p. 190 (part: Singapore); Proc. Zool. Soc. London, 1887, p. 146 (Riu Kiu Islands).—OKADA, Cat. Vert. Japan, 1891, p. 71 (Okinawa).—FRITZE, Zool. Jahrb. Syst., VII, 1894, p. 860; author's separate, p. 11.

Thanks to the courtesy of the authorities of British Museum, I have been able to compare Pryer's specimen, said to have come from "Loo-Choo," with the type of Gray's *P. horsfieldii* (which is a female and consequently lacks the pores) from Singapore, and found them to agree completely. A male from Mount Dulit, Borneo, in the same museum, differs only in having three more preanal pores.

Description (figs. 164–166).—*Adult male:* British Museum, No. 87. 1. 31. 5; "Loo-Choo Islands;" presented by Mr. Pryer. Rostral almost quadrangular, large, at upper corners entering nostrils; the latter surrounded by rostral, first labial, one postnasal, and two supranasals; between the anterior supranasals a large nearly quadrangular shield separating them entirely and joining the rostral; twelve supralabials; mental small triangular, followed by a pair of

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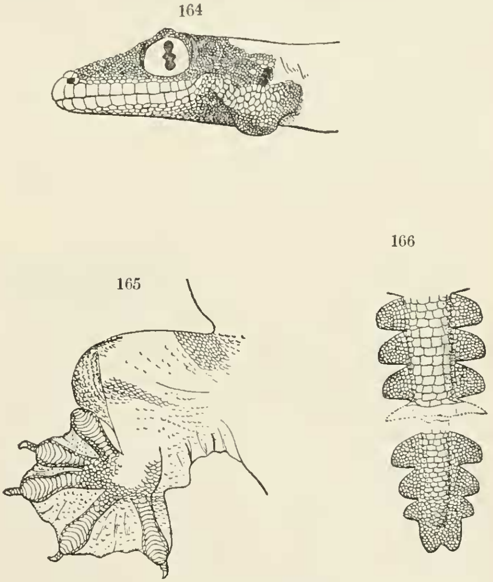
[a] From *πτυξ*, a fold; *ζωον*, an animal.

[b] *Ptychozoon kuhli* is Creveld's *Lacerta homalocephala*, the name of which is preoccupied. See Stejneger, Proc. Biol. Soc. Washington, XV, March 5, 1902, p. 37.

[c] Named for Dr. Thomas Horsfield. Born May 12, 1773, at Bethlehem, Pennsylvania; died in London, July 14, 1859. Lived a long time in Java. Author of Zoological Researches in Java, etc. (1821–1824), and Plantae Javanicae, 3 vols. (1838–1852).

elongated median postmentals; top of head, back, and throat covered with uniform granules, without tubercles, belly with scales several times larger than the dorsal granules; parachute covered above with larger quadrangular scales in horizontal rows alternating like bricks in a wall, below apparently entirely without scales; an angular series of eight preanal pores, and a series of about twelve smaller pores near the distal end of the femur; the whole animal is strongly depressed and laterally surrounded by a series of dermal expansions or flaps, the one on the body between axilla and groin assuming the character of a parachute, being more than one-half the width of the whole body; a small flap behind angle of mouth underneath the ear-opening, one in the angle between upper and lower arms, and a small one on the posterior side of each of these; similar flap in angle between femur and tibia behind, and a small one on the outer side of the tibia, but none on the femur; tail with a lateral series of small rounded lobes, gradually decreasing in size toward the tip which is not expanded; the segments thus indicated by each pair of lobes are further marked by a couple of slightly enlarged flat scales on the upper surface of the tail near the median line; hands and feet webbed to the tips of the digits. Color (in alcohol) light drab gray above with four narrow, wavy, dusky cross bands on the back and six wider bars on the tail; a line of ill-defined circular spots of same color from eye to shoulder; underneath whitish.



Figs. 164-166.—Ptychozoon horsfieldii. 1⅓ × nat. size. 164, side of head; 165, underside of right hind leg and foot; 166, underside of tail, middle and terminal portions. No. 24030, U.S.N.M.

Dimensions.

	mm.
Total length	130
Snout to vent	68
Vent to tip of tail	62
Snout to eye	8
Snout to ear-opening	18
Width of head	15
Fore limb	32
Hind limb	62

The *female* lacks preanal and femoral pores.

Habitat.—This remarkable species is an inhabitant of the Malayan peninsula, the Natuna Islands, and Borneo.

A single specimen presented by Mr. Pryer to the British Museum as having been obtained by his Japanese collector in the Riu Kiu Islands, is the only one thus far recorded east and north of the region indicated above. As no other collectors have found it in the Riu Kius or the intervening regions, I may perhaps be justified in expressing a doubt as to the correctness of the locality. It may be remembered that Pryer himself did some collecting in Borneo in 1880, and it is possible that the specimen in question may have become mixed up with the Riu Kiu collection.

List of specimens of Ptychozoon horsfieldii.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.
Brit. Mus	87. 1. 31. 5	Male[a]	Loo Choo Islands [?]		H. J. S. Pryer.
U. S. N. M	24030	Female[b]	Trong, Lower Siam	1897	Dr. W. L. Abbott.

[a] Description, p. 170. [b] Figs. 164–166.

Genus HEMIDACTYLUS[a] Oken.

1817. *Hemidactylus* Oken, Isis, 1817, p. 1183 (based on Cuvier's "Hemidactyles," type "Gecko tuberculeux Daudin").

1843. *Tachybates* Fitzinger, Syst. Rept., p. 105 (type, *H. mabouia*).

1843. *Pnoëpus* Fitzinger, Syst. Rept., p. 106 (type, *H. javanicus*=*H. frenatus*).

The above synonymy refers chiefly to the species occurring within our limits. For others see my "Land Reptiles of the Hawaiian Islands."[b]

Only one species of true *Hemidactylus* has been reported from our territory thus far. Another is here recorded for the first time. They may be distinguished as follows:

a^1 Inner digit very small, with a short sessile terminal joint, the claw of which is usually very minute; males with the femoral pores continued across the belly. *H, frenatus*, p. 172.

a^2 Inner digit not disproportionately small, well developed, with a free erect terminal joint, which is provided with a well-developed claw; males with femoral series of pores interrupted on the middle of the belly .... *H. bowringii*, p. 176.

HEMIDACTYLUS FRENATUS[c] Duméril and Bibron.

1836. *Hemidactylus frenatus* Duméril and Bibron, Erpét. Gén., III, p. 366 (type-localities, Java and Timor).—Boulenger, Cat. Liz. Brit. Mus., I, 1885, p. 120 (Taiwan fu, South Formosa; Korea).—Brown, Proc. Phila. Acad., 1902, p. 183 (Loo Choo Islands, probably Okinawa shima).

1860. *Hemidactylus inornatus* Hallowell, Proc. Phila. Acad., 1860, p. 492 (type-locality, Okinawa shima; type, U.S.N.M. No. 7429; Stimpson, collector).

1868. *Hemidactylus longiceps* Cope, Proc. Phila. Acad., 1868, p. 320 (type-locality, Manila, Philippine Islands.).

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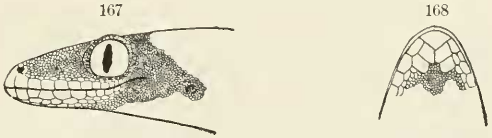
[a] From ἡμι, half; δακτυλος, digit.

[b] Proc. U. S. Nat. Mus., XXI, 1899, p. 791.

[c] Signifying bridled; alluding to the dusky streak on the lores (*frenum*).

Description (figs. 167–168).—*Adult male;* U.S.N.M. No. 34202; Ishigaki shima, Riu Kiu Archipelago; June, 1899; A. Owston, collector. Rostral squarish, broader than high, upper outer corner entering nostril, a median cleft behind; nostril between first supralabial, rostral, and three nasals, of which the upper and the lower are larger than the one between; distance from nostril to eye scarcely longer than from eye to ear-opening; diameter of eye a little more than half its distance from tip of snout; ear-opening small, oval; 11 supralabials; mental large, triangular followed by a median pair of large oblique chin-shields broadly in contact; an outer pair of equally large shields extends a short distance back of the median pair, in contact with first and second lower labials; granules of throat extending close up to the chin-shields; upper surface covered with small granules, those on occiput, supraocular and interorbital region smallest, those on lores, rostral canthus, and anterior portion of snout largest; among the granules a few isolated rounded tubercles on lower back; first digit very small, the terminal compound joint scarcely free and with a very minute claw; six pairs of lamellæ, one terminal and two basal single lamellæ under fourth toe; under surface covered with small, flat, slightly imbricate scales except on throat, where the scales are reduced to small granules; a continuous series of 31 femoral pores meeting at an angle in front of anus; tail gradually tapering, cylindric toward the tip, more flattened toward the base, covered above with small scales with indication of annulation, the posterior outline of the annuli being marked by three large pointed tubercles on each side and forming longitudinal series; underside of tail with a median series of wide plates. Color (in alcohol) above pale drab gray, with faint indications of dusky mottlings and cross marks; a pale broad band from nostril through eye and over temporal region, bordered above and below by an obscure narrow dusky line; labials mottled with dusky brown; underside whitish.



FIGS. 167–168.—HEMIDACTYLUS FRENATUS (TYPE OF *H. inornatus*). 2 × NAT. SIZE. 167, SIDE OF HEAD; 168, CHIN. NO. 7419, U.S.N.M.

Dimensions.	*mm.*
Total length	99
Snout to vent	45
Vent to tip of tail	54
Snout to ear-opening	13
Greatest width of head	9.5
Fore limb	15
Hind limb	18

The adult *female* (No. 34196, same locality and collector) differs chiefly in the absence of femoral pores.

Variation.—The greatest amount of individual variation is seen in the number of tubercles on the back. In most specimens the tubercles are confined to the posterior half of the back, but in some examples scattered tubercles are found as far forward as the shoulder, while in others, as in the specimens described above, they are nearly absent. Sex does not seem to have anything to do with it, for we have males and females with numerous tubercles, as, for instance, Nos. 34206 and 34200, and likewise males and females almost devoid of tubercles, as Nos. 34199 and 34196.

The number of femoral pores in the males varies in the series before me between 28 and 35.

The size and mutual arrangement of the postnasals, and also of the chin-shields, are subject to some variation from what is described above; thus the outer pair of chin-shields are often excluded from contact with the first lower labial.

The reproduced tail is somewhat shorter and stouter at the base than the original one, the scales are somewhat larger and less regularly arranged, and there are no tubercles. The transverse plates on the underside are well developed, however.

Habitat.—One of the most widely distributed species of geckos, which has been carried in cargoes to many distant localities. It has recently been found in western Mexico, and it occurs also in St. Helena, in the South Atlantic. From South Africa and Madagascar it extends through the various groups of islands, India, Malayan Peninsula and Archipelago, northern Australia, Philippine Islands, Hainan, southern and eastern coast of China, to Formosa, Riu Kiu Islands, and Korea.

From the latter country there is a specimen in the British Museum presented by Sir E. Belcher, and in the same museum several from Taiwan fu, southern Formosa. Another specimen from Formosa is in the museum at Bergen, collected by Capt. von der Ohe. It has been collected in the "Loochoo Islands," as recorded by Dr. A. E. Brown, and specimens similarly labeled are in the Hamburg Museum from Doctor Warburg (No. 1152). Doctor Lenz, March 13, 1897, collected four specimens on Iriomote Island, of the Yaeyama group (Hamb. Mus., No. 1899), and the United States National Museum has 22 specimens from Ishigaki Island, of the same group. Finally, the Science College Museum, in Tokyo, has a number of specimens (No. 40) from Miyako shima, in the same group, and a single one (No. 41) from Naha, Okinawa shima, all collected by Tashiro.

List of specimens of Hemidactylus frenatus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Femoral pores.
U.S.N.M.	7429*a*	Female[a]	Okinawa shima	Nov. —, 1854	W. Stimpson	
Do	7429*b*	Young	Okinawa shima (?)	do	W. Stimpson (?)	
Do	7429*c*	do	do	do	do	
Do	34191	Male	Ishigaki shima	June —, 1899	A. Owston	28
Do	34192	do	do	do	do	28
Do	34193	do	do	do	do	31
Do	34194	do	do	do	do	29
Do	34195	do	do	do	do	28
Do	34196	Female	do	do	do	
Do	34197	Male	do	do	do	30
Do	34198	do	do	do	do	31
Do	34199	do	do	do	do	33
Do	34200	Female	do	do	do	
Do	34201	Male	do	do	do	31
Do	34202	do.[b]	do	do	do	31
Do	34203	do	do	do	do	29
Do	34204	do	do	do	do	30
Do	34205	do	do	do	do	26
Do	34206	do	do	do	do	35
Do	34207	Female	do	do	do	
Do	34208	Male	do	do	do	33
Do	34209	do	do	do	do	29
Do	34210	Female	do	do	do	
Do	34212	do	do	do	do	
Do	34213	Male	do	do	do	31
Do	36529	do.[c]	Miyakoshima	do	do	33
Do	36530	do.[c]	do	do	do	29
Imp. Mus. Tokyo	2	do	Okinawa shima			31
Do		Female	do			
Do		Male	do			31

[a] Type of *H. inornatus* (figs. 167-168). [b] Description, p. 173. [c] Sci. Coll. No. 40

HEMIDACTYLUS MARMORATUS[a] Hallowell.

1860. *Hemidactylus marmoratus* Hallowell, Proc. Phila. Acad., 1860, p. 491 (type-locality, Loo Choo).—Boulenger, Cat. Liz. Brit. Mus., I, 1885, p. 113.

The type has apparently been lost, and no species of *Hemidactylus* answering to Hallowell's description, which is very defective, to say the least, has been brought from the Riu Kiu Archipelago. Under these circumstances it may be useful to reproduce here Hallowell's original description in full, the obvious errors being corrected, as explained in the footnotes.

Description.—Mental plate pentangular, small; a transverse row of plates immediately behind the mental and first infra-labials; the two middle much larger than the lateral ones; behind these several series of unequal scales, larger than those upon the throat;[a] eleven supra-labials on each side; rostral[b] plate pentangular, much broade than high, presenting an angle posteriorly; scales upon the muzzle and in front of the orbits, nearly equal, small; head covered with small granulations; five rows of very small circular tubercles on each side of the back above; a row of seven pores in front of the anus. Color grayish, marked all over with black; abdomen white; chin and throat white, marked with brown.

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[a] Signifying marbled; with dark markings like the veins in marble.

Dimensions.—Length of head 7 lines; greatest breadth 4½ lines; length of head and body 1 inch 8 lines.

Habitat.—Loo Choo. One specimen.

It is just possible that Hallowell had before him a *Gekko japonicus* so shriveled or mutilated that the subdigital lamellæ appeared to be divided.

HEMIDACTYLUS BOWRINGII[c] (Gray).

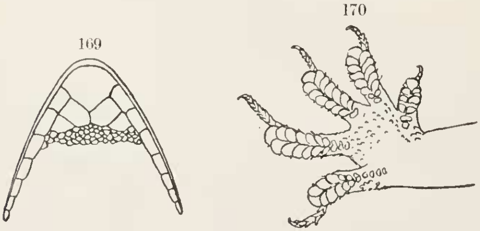
1845. *Doryura bowringii* Gray, Cat. Liz. Brit. Mus., p. 156 (type-locality unknown; types in Brit. Mus.).—*Hemidactylus bowringii* Boulenger, Cat. Liz. Brit. Mus., I, 1885, p. 139, pl. xii, fig. 2 (Burma; Northern and Central India); Fauna Brit. India, Rept., 1890, p. 93 (Eastern India, Burma, and Tenasserim).

1853. *Leiurus berdmorei* Blyth, Journ. Asiat. Soc. Bengal, XXII (p. 646) (type-locality, —).

1860. *Hemidactylus pumilus* Hallowell, Proc. Phila. Acad., 1860, p. 502 (type-locality, Hongkong).

1872. *Hemidactylus coctæi* Guenther, Ann. Mag. Nat. Hist. (4), IX, Jan. 1872. p. 86 (part; not of Duméril and Bibron).—Mueller, Kat. Amph. Rept. Mus. Basel, 1878 (p. 637) (Lilong and other localities in province of Canton).—Boettger, Offenbach. Ver. Naturk. 24–25 Ber., 1885, p. 138.

Description.—Adult male; U.S.N.M. No. 34188; northern Formosa; June 23, 1903; A. Owston, collector (figs. 169–170). Rostral squarish, broader than high, with a median cleft behind, the upper corners entering the nostrils; a pair of internasals separated by a small scale; nostril surrounded by first supralabial, rostral, internasal and two small scales; eye equidistant from nostril and ear-opening; supralabials 12 on left side, 10 on right; mental large, triangular, or rather subpentagonal, followed by a median pair of large chin-shields, on the side of which a lateral pair of much smaller shields which



FIGS. 169–170.—HEMIDACTYLUS BOWRINGII. 3 × NAT. SIZE. 169, CHIN; 170, UNDERSIDE OF FOOT. NO. 34188, U.S.N.M.

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[a] The last paragraph in the original text follows immediately after the first sentence describing the mental plate; it is evidently misplaced and must be inserted in the position here given to it.

[b] The original text has "ventral," evidently a slip for rostral.

[c] Named after Charles Bowring, esq., who presented the types to British Museum.

do not extend backward beyond the median pair; granules on throat immediately join the chin-shields; upper surface covered with uniform granules (without trace of interspersed tubercles) those on vertex and on supraocular region smaller, those on snout and lores larger; first digit well-developed with a well-developed, free, and raised terminal joint provided with a full-sized claw; six lamellæ, of which three in pairs, under first toe; ten lamellæ, of which six in pairs, under fourth toe; throat covered with uniform granules, rest of under surface with small, rounded, imbricate scales; a well-developed series of 13 pores on each femur, not meeting on the middle of the abdomen, nor reaching the knee joint; tail subcylindric, more depressed near base, tapering, covered with uniform small scales of about the same size as the large granules on the snout; underside of tail covered with a median series of wide transversal plates. Color (in alcohol) above dark drab gray a with obscure brown marblings; scarcely discernible dark band from lores through eyes, above ear-opening to side of neck, and a similar one on parietal region; underside whitish.

Dimensions.

	mm.
Total length	88
Snout to vent	50
Vent to tip of tail (reproduced)	38
Snout to ear-opening	13
Greatest width of head	10
Fore limb	15
Hind limb	20

The adult *female* (U.S.N.M. No. 34211; Ishigaki Island, Riu Kiu; Owston collection) differs in the absence of femoral pores.

The most marked deviation, due to individual variation, from the specimen described above is the presence of a second lateral pair of chin-shields, smaller than the others, but well differentiated.

Remarks.—The specimens here recorded from Formosa and Riu Kiu have not been compared with Indian specimens, but they agree so completely with the published descriptions that I have no doubt that they are correctly identified. The well-developed inner toe with long terminal free phalanx and large claw, the series of 13 to 14 femoral pores on each side interrupted on the middle of the abdomen, and the tail devoid of tubercles indicate *H. bowringii* beyond a doubt.

The fact that this species has hitherto been recorded only from India, Burma, and Tenasserim is of no weight now, since Dr. Jean Roux, curator of the herpetological collection in the Basel Museum, informs me that the *H. coctæi* recorded by Mueller in the catalogue of that museum as from "Liolong and other localities in the province of Canton," China, is in reality *H. bowringii*, a fact of which he has assured himself by repeated and careful examinations and comparisons with allied species.

Habitat.—This species is known to inhabit the mainland of India, Burma, and Tenasserim, and as shown above, it is now recorded from the province of Canton in China. A single specimen collected in June, 1899, in "northern Formosa" and obtained from Mr. Alan Owston, is now in the United States National Museum. It is the first record of this species in the island.

Another specimen, a female, from Ishigaki shima, of the Yaeyama group, Riu Kiu Archipelago, was found among a lot of 22 specimens of *H. frenatus.* This species is probably much rarer than *H. frenatus,* or has different habits which result in its being more rarely caught.

List of specimens of Hemidactylus bowringii.

U. S. N. M. No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Femoral pores.
34188	Male[a]	North Formosa	June 23, 1903	A. Owston	13
34211	Female	Ishigaki shima, Riu Kiu	June —, 1899	do	

[a] Description, p. 176; figs. 169-170.

Genus COSYMBOTUS[a] Fitzinger.

1836. *Platyurus* OKEN, Allgem. Naturgesch., VI, p. 641 (not *Platurus* Latreille, 1802).

1843. *Cosymbotus* FITZINGER, Syst. Rept., p. 104 (type, *H. platyurus*).

1858. *Crossurus* GIRARD, Herpet. U. S. Expl. Exped., p. 281 (same type; not of Wagler 1830).

1864. *Nycteridium* GUENTHER, Rept. Brit. India, p. 111 (same type).

COSYMBOTUS PLATYURUS[b] (Schneider).

1792. *Stellio platyurus* SCHNEIDER, Amph. Physiol., II, p. 30 (no type-locality given; type in coll. Rebelt).—*Hemidactylus platyurus* BOULENGER, Cat. Liz. Brit. Mus., I, 1885, p. 143 (India, South China, Malay Peninsula and Archipelago; Philippines).

1798. *Lacerta platyuros* DONNDORF, Zool. Beytr., III, p. 133 (emendation).

1802. *Lacerta schneideriana* SHAW, Gen. Zool., III, Pt. 1, p. 1278 (substitute name).

1829. *Gecko marginatus* CUVIER, Règne Anim., 2 ed., II, p. 54.

1864. *Nycteridium schneideri* GUENTHER, Rept. Brit. India, p. 111 (emendation).

Description.—Adult male; Bergen Museum; Formosa; von der Ohe, collector. Rostral broader than high, in contact behind with two supranasals and a small scale between the latter; first supralabial in contact with a postnasal and reaching nostril; nostril between rostral, first supralabial and three smaller scales behind and above; 10 supralabials bordered above by a series of enlarged granules; scales on top of head granular, somewhat larger on snout, still larger on the loreal region; eye nearer ear-opening than nostril; large, about two-thirds the distance from ear-opening, which is small, about the size of one of the larger supralabials; mental shield large, pentagonal, in contact behind with first lower labials and one pair of large postmentals, which are followed by another pair of equal size not in contact with each other; 7 larger lower labials which are bordered by a series of enlarged granules; body and legs above covered with small uniform granules; body and extremities below, as well as upper surface of feet, covered with larger imbricate scales, those on throat and underside of lateral fold, however, smaller, scarcely larger than the dorsal granules; from axilla to groin a thin skin flap about 2 mm. wide, and a similar fold along the posterior edge of thigh and tibia; five pairs of plates under shortest toe and eight pairs under longest; four toes nearly half webbed, hallux free; tail flat, with sharp, almost fin-like, and serrated edges, and a strong basal constriction; it is covered with somewhat pointed imbricate scales and underneath with a median series of about 40 wide subcaudal plates; at the basal origin of the flap-like lateral expansion of the tail a number of well-differentiated elongated spines; femoral pores continuous from knee across the belly, 20 on each side. Color (in alcohol) above drab with indistinct marblings of darker and lighter color; a distinct dark band from loreal region through lower part of eye and above ear to shoulder; below whitish.

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[a] From κοσυμβωτός, fringed, tasseled. [b] From πλατὺς, flat; ὀυρὰ, tail.

Dimensions.

	mm.
Total length	88
Snout to vent	46
Vent to tip of tail	42
Snout to ear-opening	13
Greatest width of head	9.5
Fore leg, from axilla	16
Hind leg, from groin	23

Remarks.—From the above description it will be seen that the Formosan specimen agrees in all essential points with those from other localities. The second pair of postmentals is unusually large, but I have before me (in Bergen Museum) a specimen from Luzon, in the Philippines, which is halfway in this respect between normal specimens and the Formosan specimen.

Habitat.—This gecko is widely distributed from India and the East Indian Archipelago to southern China and the Philippines. So far as I know it is here recorded from Formosa for the first time. It was collected in the early sixties by Captain von der Ohe, from Bergen, who during his eastern cruises collected extensively for the museum in his native city.

List of specimens of Cosymbotus platyurus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.
Bergen		Male[a]	Formosa		Capt. von der Ohe.

[a] Description, p. 178.

Genus PEROPUS[a] Wiegmann.

1835. *Peropus* WIEGMANN, Nova Acta Acad. Leop. Carol., XVII, Pt. 1, p. 238 (type, *H. mutilatus*).

1843. *Dactyloperus* FITZINGER, Syst. Rept., p. 103 (type, *H. variegatus*).

1845. *Peripia* GRAY, Cat. Liz. Brit. Mus., p. 158 (type, *H. peronii=mutilatus*).

1883. *Chalinocnemis* DUGÈS, La Naturaleza, VI, p. 312 (type, *H. navarri=mutilatus*).

1883. *Spasmocnemis* DUGÈS, La Naturaleza, VI, p. 312 (same type).

Wiegmann's genus *Peropus* of 1835 antedates that of Lay and Bennett for a genus of fishes, as the Zoology of the *Blossom*, in which the latter occurs for the first time, was not *published* until 1839.[b]

PEROPUS MUTILATUS[c] (Wiegmann).

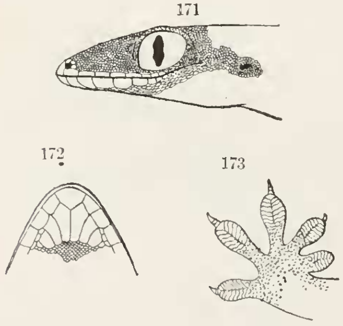
1834. *Hemidactylus mutilatus* WIEGMANN, Herpet. Mex., I, p. 54 (type-locality, Manila) (corrected for *H. pristiurus*, op. cit., p. 20).—*Hemidactylus* (*Peropus*) *mutilatus* WIEGMANN, Nova Acta Acad. Leop. Carol., XVII, Pt. 1, 1835, p. 238.—*Gehyra mutilata* BOULENGER, Cat. Liz. Brit. Mus., I, 1885, p. 148 (Mascarene Islands to Mexico).—*Peropus mutilatus* GIRARD, Herp. U. S. Expl. Exped., 1858, p. 277 (Philippines).—STEJNEGER, Proc. U. S. Nat. Mus., XXI, no. 1174, 1899, p. 796 (Hawaiian Islands).

1857. *Dactyloperus insulensis* GIRARD, Proc. Phila. Acad., 1857, p. 195; author's separate, p. 5 (type-locality, Sandwich Islands).

1883. *Hemidactylus navarri* DUGÈS, La Naturaleza, VI, p. 311, pl. VII*a* (type-locality, Tangancicuara, Michoacan, Mexico).

For complete synonymy see Stejneger, Land Reptiles of the Hawaiian Islands.[d]

Description (figs. 171–173).—*Adult female;* Bergen Museum; Formosa; von der Ohe, collector. Rostral broader than high, with a median cleft above, in contact with two supranasals and a minute granule between the latter; first supralabial in contact with the lower postnasal and reaching nostril; nostril between rostral, first supralabial and three scales behind and above, the upper one of which is large and in contact behind the rostral with the corresponding scale of the other side; 9 supralabials; scales on top of head finely granular, slightly larger on snout; eye equidistant from nostril and ear-opening, large, more than two-thirds its distance from ear-opening which is moderate, somewhat larger than one of the largest



FIGS. 171–173.—PEROPUS MUTILATUS. 2 × NAT. SIZE. 171, SIDE OF HEAD; 172, CHIN; 173, UNDERSIDE OF FOOT. No. 26395, U.S.N.M.

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[a] From πηρὸς, mutilated; and πούς, foot.

[b] Liter. Gaz. and Journ. Belle Lett., London, no. 1179, p. 542, Aug. 24, 1839, where, according to T. S. Palmer, Index Gen. Mamm., p. 16, it is first mentioned in the list of new books. A review printed in Mag. Nat. Hist., London, March, 1840, begins thus: "The long-looked for and long-despaired of zoology of Beechey's Voyage is at last before us."

[c] Signifying mutilated.

[d] Proc. U. S. Nat. Mus., XXI., 1899, p. 796.

supralabials; mental shield rather small, triangular, followed by six chin-shields in one transverse series, their posterior outline forming together a straight line, the median pair being large, elongate pentagonal, the others gradually smaller toward the sides, the largest pair longer than diameter of eye; 9 large lower labials; body and legs above covered with small uniform granules like those on head; throat with granular scales of same size as those on back, those on rest of under surfaces, including those of the legs, larger, distinctly imbricate, and rounded behind; on the flanks a barely indicated longitudinal fold, and a somewhat better developed fold along the posterior edge of thigh and tibia; toes slightly webbed at base; about 8 pairs of lamellæ under longest toe and 6 under the shortest; tail (reproduced) rather flat, with sharp, finely serrated lateral edge, covered, with small, somewhat pointed, imbricate scales above and with a median series of wide plates bordered on each side by a somewhat irregular series of enlarged scales; about 5 mm. from the base the tail has a distinct lateral indentation; no femoral pores. Color (in alcohol) above browinish drab with faint indications of darker marblings, below whitish.

Dimensions.

	mm.
Total length	60
Snout to vent	33
Vent to tip of tail	27
Snout to ear-opening	8.5
Greatest width of head	7
Hind leg, from groin	12

Remarks.—The specimen agrees in most particulars with other specimens of this species.

The *males* have femoral pores in a continuous angular series across the abdomen, 14 to 19 on each side.

For further remarks as to variation, etc., see Proceedings United States National Museum, XXI, 1899, p. 798.

Habitat.—Irregularly distributed over various islands and coasts in the Indian Ocean, from the Mascarenes and Seychelles to the Philippines. This species seems very easily transported in ships, as evidenced by an apparently recent colony in western Mexico, and another in Hawaii. Its occurrence in Formosa and the Riu Kius is therefore not surprising. It was collected in Formosa during the early sixties by Capt. von der Ohe, who brought a single specimen to the museum at Bergen, Norway. This is the only record of its having been taken in Formosa.

Another specimen is in the Hamburg Museum (Saur., No. 1151), collected by Doctor Warburg in the Riu Kius, without further data.

List of specimens of Peropus mutilatus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.
U.S.N.M.	26395	([a])	Manila, P. I.		G. C. Lewis.
Bergen		Female [b]	Formosa		Capt. von der Ohe.
Hamburg	1151		Riu Kiu Islands		Dr. O. Warburg.

[a] Figs. 171-173.

[b] Description, p. 180.

Family AGAMIDÆ.

Lizards with a thick villose tongue and acrodont teeth; no large symmetrical plates on head or abdomen.

Distributed over the tropical and subtropical regions of the Old World, principally the Indian region; they are absent in Madagascar. The family contains both terrestrial and arboreal species, the former usually with a depressed body, the latter of a compressed shape. Some are insectivorous, others again herbivorous.

Only one genus occurs in Japanese territory.

Genus JAPALURA[a] Gray.

1853. *Japalura* Gray, Ann. Mag. Nat. Hist. (2), XII, p. 387 (type, *J. variegata*).

1853. *Biancia* Gray, Ann. Mag. Nat. Hist. (2), XII, p. 387 (type, *B. niger*=*J. variegata*).

1860. *Diploderma* Hallowell, Proc. Phila. Acad., 1860, p. 490 (type, *D. polygonatum*).

1863. *Iapalura* Swinhoe, Ann. Mag. Nat. Hist. (3), XII, p. 225 (emendation?).

1890. *Pelturagonia* Moquard, Le Naturaliste, XII (p. 144) (type, *P. cephalum*).

Species of this genus occur from the Himalayas and eastern Bengal through Assam to western China. One species each is known from Borneo, Formosa, Botel Tobago, and the Riu Kiu Archipelago.

KEY TO THE JAPANESE SPECIES OF JAPALURA.

*a*¹ Width between outer superciliary edges at center of eye exceeding length of third toe, without claw.
  - *b*¹ Fourth toe, without claw and measured from base of third, longer than distance from center of eye to tip of snout; throat dark with numerous roundish white (in alcohol) spots........ *J. swinhonis*, p. 184.
  - *b*² Fourth toe, without claw and measured from base of third, usually not longer than distance from center of eye to tip of snout; throat light colored, uniform or with converging dark lines........ *J. polygonata*, p. 188.

***a*²** Width between outer superciliary edges at center of eye not exceeding length of third toe, without claw........ *J. mitsukurii*, p. 190.

As already indicated by Boulenger, *Japalura swinhonis*, from Formosa, and *J. polygonata*, from the Riu Kius, are very closely related, but the recent acquisition of a large series of specimens from Ishigaki shima shows a relationship even more close than was supposed by him. Not that the two forms are not distinct. On the contrary, there are quite a number of distinctive characters, but it is exceedingly difficult to express them in words and it is doubtful whether there is any *single* character which will separate the two forms in all cases.

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[a] Derivation obscure; possibly the J is a misprint (?) for H, from ἁπᾰλός, fine, and *ουρα*, tail.

Boulenger found the difference to be chiefly one of proportions and coloration. He stated[a] that *J. polygonata* "differs in having the tibia constantly shorter than the skull, fewer labials as a rule, and in coloration," the inference being that in *J. swinhonis* the tibia is constantly at least as long as the skull. Unfortunately, however, the inference is not borne out by our material, since in several of the Formosa specimens of *J. swinhonis*, thus in U.S.N.M. Nos. 34084 and 34089, both old males, the tibia is decidedly shorter than the skull, as much so as in several Ishigaki shima specimens. It is true, nevertheless, that the Formosan form has the hind limbs longer as a rule, and this is more especially marked when we examine specimens of the male sex, since the females as a rule are somewhat more short-legged. *J. swinhonis* has a relatively longer fourth toe, the latter extending farther beyond the third than in *J. polygonata*, but the difference is so small that it defies a definite expression which would make it possible to use it as a criterion in a "key" for identification. A better result is obtained if we compare the length of the fourth toe (without claw) from the base of the third with the distance from the center of the eye to the tip of the snout. In most cases *J. swinhonis* has the fourth toe decidedly longer than this distance, while in *J. polygonata* it is usually equal or smaller.

The number of supralabials offers no tangible diagnosis. There are 7 or 8 labials in about equal proportion among over 20 Ishigaki shima specimens, not one with six.

The coloration furnishes possibly the best distinction, at least among the adults. While there are several of the adult males of the Ishigaki specimens which show a whitish lateral band quite distinctly and thus differ from the uniform green color of some of the Okinawa adult males, there is one color character in which all the old Formosan specimens agree, viz, in having the throat dark with large distinct white spots. This pattern is not found in any of our Riu Kiu specimens in which the throat is whitish more or less suffused with rust-red, uniform in the males but in the females marked with irregular longitudinal dusky lines converging posteriorly. In the latter there is also a more or less conspicuous longitudinal pale line under the eyes parallel with the upper lip, while in the Formosan specimens there are distinct blackish lines running from the eye to the lip.

There are several other minor characters of more or less constancy which are real enough though hard to express. Thus, the outline of the head is somewhat different especially when viewed from below, inasmuch as in *J. swinhonis* the rami of the jaw are more convex than in *J. polygonata* in which they are more straight. In the latter the ventral scales are possibly a trifle larger, but I have been unable to establish a ratio. It also seems as if the spines of the nuchal crest were more conical and pointed, while in *J. swinhonis* they are wider and more rounded toward the apex.

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[a] Proc. Zool. Soc. London, 1887, p. 146.

When establishing *J. mitsukurii*, I had only one Formosan specimen for comparison. The latter was then unhesitatingly taken for a typical *J. swinhonis*, but the 17 specimens from Formosa since received put a somewhat different aspect on the whole question. The single specimen referred to shows such aberrant characters that I have become dubious as to its Formosan origin, or if it really comes from that island whether it may not represent a different species, questions which will be discussed farther on under the head of *J. swinhonis*. An examination of the large series of typical specimens of the latter now shows that the principal character upon which I relied for the diagnosing of the Botel Tobago form, viz, the absence of a specially differentiated series of larger scales between the eye and the upper labials, does not hold. But there are other differences separating it from both the other forms. In coloration *J. mitsukurii* agrees most with *J. swinhonis*, but the throat is much paler and the white markings on it, instead of being isolated roundish spots, form more or less distinct bands across the throat. In some of its proportions it also comes close to *J. swinhonis*. Thus, for instance, the distance from center of eye to tip of snout is very much less than the length of the fourth toe from the base of the third. Both feet and tail are longer. On the other hand, the head is much narrower and its lateral outline much straighter, in this respect resembling *J. polygonata*, only exceeding it. This narrowness of the head compared with the elongation of the toes furnishes a good character for distinguishing *J. mitsukurii*.

JAPALURA SWINHONIS[a] Guenther.

1864. *Japalura swinhonis* GUENTHER, Rept. Brit. India, p. 133, pl. XIV, fig. *B* (type-locality, Tamsui, Formosa; type in Brit. Mus.; Swinhoe collector; see Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225).—BOULENGER, Cat. Liz. Brit. Mus., I, 1885, p. 309 (Formosa); Proc. Zool. Soc. London, 1887, p. 146.—MUELLER, Verh. Naturf. Ges. Basel, VIII, Pt. 2, 1887, p. 294 (southern Formosa).—? STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 218 (Taipa, Formosa).

1885. *Japalura swinhoei* BOETTGER, Offenbach. Ver. Naturk. 24–25 Ber., 1885, p. 140 (emendation).

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[a] Named for Robert Swinhoe, then British consul in Formosa, known from his investigation of the Chinese and Formosan faunas. He was born in Calcutta, September 1, 1836, and died in London, October 28, 1877. He was in the British consular service in China from 1854 to 1873.

A single adult female specimen (Sci. Coll. Mus. No. 22) said to have been collected by Mr. Tada at Taipa, Formosa, during July, 1896, has been recorded by me as *Japalura swinhonis*[a] with the statement that "it agrees well with the published description." At that time I had no other Formosan specimens for comparison, and only three from Okinawa. The fine series of typical *J. swinhonis* from Formosa, and of *J. polygonata* from Ishigaki shima, now at hand, make the specimen in question appear in a somewhat different light. In fact, it presents so many peculiarities differing from all the three forms known from our territory that I do not know whether to regard it as an individual freak or a new species, in which case one might be tempted to question the correctness of the alleged habitat.

It has the dark dorsal cross-bars of the Formosan *J. swinhonis* as well as the white lateral longitudinal band, only the latter is unusually wide, but the throat is entirely uniform white, showing none of the characteristic pattern found in all our adult specimens of the latter. In addition it has the uninterrupted white longitudinal streak found in the *J. polygonata* of the Yaeyama group.

The proportions are very different from those of the normal Formosan specimens, and would even be considered extreme among the *J. polygonata*. The hind legs are exceedingly short, particularly the tibia, which is not longer than the distance from tip of snout to the posterior edge of the orbit, consequently very much shorter than the skull. The third toe, without claw, equals only three-fourths of the width between the outer superciliary edges. The distance from center of eye to tip of snout is much greater than the fourth toe measured from the base of the third. If the hind leg be carried forward along the side, the tip of the longest toe does not reach farther than the posterior edge of the (concealed) tympanum. It has seven supralabials. In addition to the above characters it has a row of enlarged scales from under the eye to the nasal, separated from the labials by a row of very narrow ones. Some of these enlarged scales are as large as some of the supralabials and three times as large as the other scales below and in front of the eye. Finally there is a very distinct row of enlarged submalar scales along the entire length of the lower edge of the mandible. In the other specimens, especially those from Formosa, only the two or three scales on each side of the mental are thus enlarged. In some of the Ishigaki shima specimens, however, a tendency to such a submalar series may be traced, but the full development as shown in the Taipa specimen seems to be unique.

It does not seem probable that the above deviations from the typical Formosan form can be due to individual variation of the ordinary kind. It may represent a freak or a sport, but in view of the many points in which it differs, this explanation does not appear plausible. That two separate species so closely related should occur in the same locality in Formosa would scarcely be accepted by herpetologists without incontrovertible proof. The question then naturally suggests itself whether by some accident a wrong locality may not have been assigned to it. To the neck of the specimen a large paper tag is firmly tied bearing the following inscription in Latin letters: "No. 22, Taipa, Formosa. 7–96," but there are good reasons for believing that this is not the original collector's field label. However, if not from Formosa proper, where could it have come from? The specimen, as we have seen, is not identical with any from the middle or southern groups of the Riukius. On the other hand, that it was part of the collection made by Mr. Tsunasuke Tada seems unquestionable. He collected in Formosa, Botel Tobago, and the Pescadores Islands. Our specimen agrees even less with *J. mitsukurii*, from Botel Tobago, than with the other two forms. Could it, then, possibly have come from the Pescadores or any other outlying island?

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[a] Journ. Sci. Coll. Tokyo, XII, Pt. 2, 1898, p. 218.

The question can not be decided now, and is thus left for future explorers in that region.

Description.—Adult male; U.S.N.M. No. 34082; northern Formosa; June 23, 1903; Owston collection. Rostral low, separated from nasal by one scale; nostril round, in a single, somewhat swollen nasal, which is in contact with first supralabial; canthus rostralis very sharp, covered with about five scales; superciliary ridge interrupted by a deep notch at the posterior end of the orbit, followed by a single low spine; various isolated spines on occiput and temporals; eight supralabials, eighth very long and narrow; all head scales wrinkled and keeled; back covered by imbricated keeled scales of at least three different sizes; a low nuchal and dorsal crest of pointed scales, those of the former slightly higher, seven in number, flattened, conical, the latter triangular, 33 in number; a similar crest on the base of the tail, the three crests being continuous, the spines over the shoulder and between the hind legs, however, being lower than the others; scales on flanks not much different from dorsals, except those back of the axilla and near the groin which are much smaller; scales on underside strongly imbricate and keeled, pointed but not mucronate; digits underneath with a double series of spiny keels; third and fourth finger nearly equal; fourth toe, without claw, from base of third considerably longer than distance from center of eye to tip of snout; third toe, without claw, from base of fourth, shorter than distance between superciliary edges at center of eye; distance from upper side of knee of hind leg, bent at right angles, to tip of longest toe without claw, longer than distance from tip of snout to inner angle of elbow; tail slightly compressed, swollen at base, covered above and below with imbricate, keeled and pointed scales. Color (in alcohol) above brownish, with a broad irregular, black-edged, pale gray band on each side of back, connected across the back by several indistinct pale chevron bands pointing backward, these chevrons occupying corresponding series of enlarged scales; head with numerous black spots, which on temples and under eye form interrupted lines radiating from the latter; throat and chest dark slate gray, the former with large, rounded, white spots; rest of underside pale gray; tail with alternating broad bands of pale gray and dark brown.

Dimensions.

	mm.
Total length	236
Snout to vent	70
Vent to tip of tail	166
Snout to center of eye	12
Greatest width of head	15.5
Fore leg	35
Hind leg	62

The *females* differ chiefly in lacking the basal swelling of the tail underneath, in the less development of the nuchal and dorsal crests, and in having the throat brown with white spots instead of dark slate gray.

The *young* have the throat uniform whitish or with faint gray marblings.

Variation.—The variation in the size and relative position of the head scales is considerable but has no immediate significance in so far as the identification of the species is concerned. The extent of individual variation of proportions and coloration has been alluded to above under the general discussion of the related forms (p. 183).

Habitat.—This species, which is restricted to the main island of Formosa, was first discovered at Tamsui by Robert Swinhoe, whose name it bears. It has since been obtained by most collectors in various parts of the island, and judging from the large number received by Mr. Owston it does not seem to be rare even in the northern part as formerly supposed. It is replaced by closely allied forms in the adjacent islands, thus by *J. polygonata* in the Riu Kius and *J. mitsukurii* in Botel Tobago.

On the Chinese mainland there is a nearly related species, *Japalura yunnanensis,* which occurs from western Yunnan to Ichang, on the Yangtse Kiang, and north into the province of Shen-si, whence we have a specimen from the Chin-ling Mountains collected by Dr. E. Blackwelder (U.S.N.M. No. 35524).

List of specimens of Japalura swinhonis.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
U.S.N.M	34082	Male [a]	Northern Formosa	June 23,1903	A. Owston.
Do	34083	do	do	do	Do.
Do	34084	do. [b]	do	do	Do.
Do	34085	do	do	do	Do.
Do	34086	do	do	do	Do.
Do	34087	do	do	do	Do.
Do	34088	do	do	do	Do.
Do	34089	do. [b]	do	do	Do.
Do	34090	Female	do	do	Do.
Do	34091	Male	do	do	Do.
Do	34092	Female	do	do	Do.
Do	34093	Male	do	do	Do.
Do	34094	do	do	do	Do.
Do	34095	Female	do	do	Do.
Do	34096	Young	do	do	Do.
Do	34097	do	do	do	Do.
Do	34098	do	do	do	Do.
Sci. Coll., Tokyo	22	Female [c]	Taipa, Formosa	Sept., 1896	T. Tada.

[a] Description, p. 186. [b] P. 183. [c] See pp. 184, 185.

JAPALURA POLYGONATA[a] (Hallowell).

Native name "ATAKAH."

Plate XIV.

1860. *Diploderma polygonatum* Hallowell, Proc. Phila. Acad., 1860, p. 490 (type-locality, Kerama shima, "Amakarima," Riu Kiu Archipelago; type U.S. N.M. No. 12203).—*Japalura polygonata* Guenther, Rept. Brit. India, 1864, p. 134.—Boulenger, Cat. Liz. Brit. Mus., I, 1885, p. 310; III, 1887, p. 493 ("Loo Choo"); Proc. Zool. Soc. London, 1887, p. 146, pl. xvii, fig. 1[b] ("Loo Choo Islands.").—Okada, Cat. Vert. Japan, 1891, p. 71 (Okinawa shima).—Boettger, Ber. Senckenberg. Naturf. Ges., 1888, Abhandl., p. 187 (O-shima, Riu Kiu); Kat. Rept. Mus. Senckenberg., I, 1893, p. 46 (O-shima); Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 107 (Okinawa shima).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 860; author's separate, p. 11 (Okinawa).—Brown, Proc. Phila. Acad., 1902, June 11, p. 184 ("Loo Choo Islands.").

This species agrees so closely with the preceding one that a detailed description is unnecessary. The differences, which consist chiefly in the shorter legs and longer and narrower head of *J. polygonata*, have been sufficiently indicated above under the general discussion of the genus (pp. 182–184).

The colors of the Okinawa shima specimens are said to be green in life. Thus Doctor Stimpson in his manuscript catalogue describes the type as being "dark green, back shaded, and tail annulated and still darker." In the alcoholics there are distinct traces of the dorso-lateral pale band as well as the pale line under the eye.

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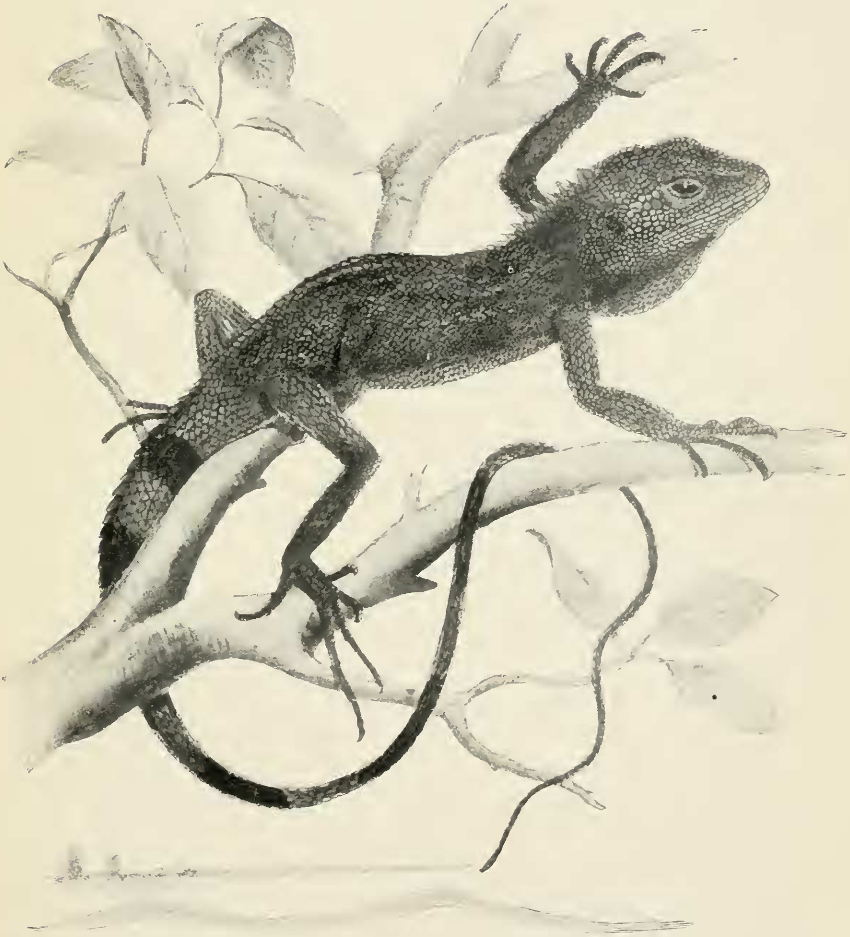
[a] From *πολύγωνος*, with many angles, referring to the polygonal scutes of the head.
[b] Reproduced in this work on Plate XIV.

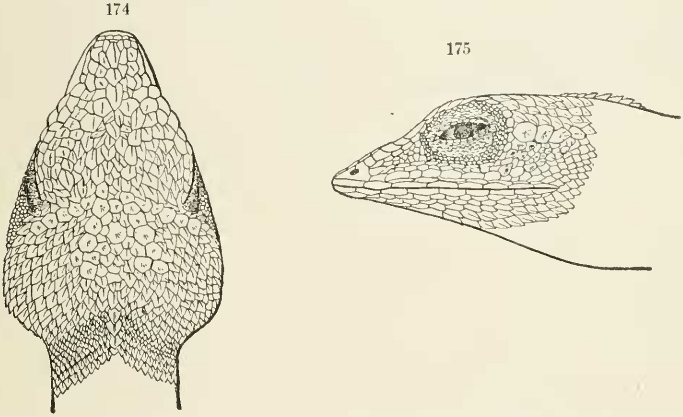


Japalura polygonata. (From Boulenger.)

For explanation of plate see page 554.

In the specimens from Ishigaki shima there are indistinct dark cross bands on the back. The males have the throat more or less uniform pale brownish gray, but in the females it is more whitish with irregular though distinct reddish brown lines running obliquely from the sides backward toward the median line. The coloring of the throat is therefore very different from what it is in *J. swinhonis.*

Dimensions.—Adult male; U.S.N.M. No. 12203; Kerama shima, Riu Kiu; type (figs. 174–175).



Figs. 174-175.—Japalura polygonata. 2 × nat. size. 174, top of head; 175, side of head. No. 12203, U.S.N.M.

	mm.
Total length (tail defective)	189
Snout to vent	66
Vent to tip of tail (defective)	123
Snout to center of eye	11
Greatest width of head	15
Fore leg	32
Hind leg	55

A full-grown male, with perfect tail, U.S.N.M. No. 34102, from Ishigaki shima measures 61 mm. from snout to vent, and 152 mm. from vent to tip of tail; total length 213 mm.

Habitat.—Originally described from a single specimen collected by the North Pacific Exploring Expedition on "Amakarima" Island, *i, e.* Kerama shima, opposite Okinawa shima, this species has since been found common on the latter island by Doctor Fritze and by Mr. Tashiro. The Science College in Tokyo has several specimens (No. 26) collected there by the latter, two of which have been presented to the United States National Museum. Mr. Pryer's specimens, now in the British Museum, reported upon by Boulenger probably also came from Okinawa.

Doctor Boettger records a specimen presented to the Senckenberg Museum by Maj. H. von Schoenfeldt as from O-shima.

From the Yaeyama group the United States National Museum has a fine series collected on Ishigaki shima by one of Mr. Owston's men, and the Science College Museum in Tokyo has three specimens from Miyakoshima (No. 27) and one from Iriomote shima (No. 32), all collected by Tashiro in 1887.

List of specimens of Japalura polygonata.

U.S. N.M. No.	Sex.	Locality.	When collected.	By whom collected or from whom received.
12203	Male[a]	Kerama shima	Apr. , 1855	North Pac. Expl. Exp.
34099	....do	Ishigaki shima		A. Owston.
34100	....do	....do		Do.
34101	....do	....do		Do.
34102	....do.[b]	....do		Do.
34103	....do	....do		Do.
34104	....do	....do		Do.
34105	....do	....do		Do.
34106	....do	....do		Do.
34107	Female	....do		Do.
34108	....do	....do		Do.
34109	Male	....do		Do.
34110	....do	....do		Do.
34111	....do	....do		Do.
34112	....do	....do		Do.
34113	Female	....do		Do.
34114	....do	....do		Do.
34115	....do	....do		Do.
34116	....do	....do		Do.
34117	Male	....do		Do.
34118	Female	....do		Do.
36519	(c)	Okinawa shima		Tashiro.
36520	(c)	....do		Do.

[a] Type, p. 189, figs. 174-175. [b] P. 189. [c] Sci. Coll. No 26.

JAPALURA MITSUKURII[a] Stejneger.

1898. *Japalura mitsukurii* STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 218 (type-locality, Botel Tobago Island; type, U.S.N.M. No. 36505; T. Tada, collector).

Japalura mitsukurii differs from *J. swinhonis* chiefly in proportions and coloration. Thus, the head, and especially the snout, is longer and narrower; the hind legs are somewhat longer, and the tail very much so. As a rule, the scales are somewhat smaller,[b] with less contrast between the extremes, but the nuchal and dorsal crests are better developed, the latter continuous with the caudal, the keels on underside sharper and the scales more pointed. The coloration is marked by about seven dark bars across the back separated by narrow pale cross stripes, which combine with the strongly defined light dorso-lateral band into a ladder pattern; the throat in the males is pale bluish (in alcohol) with large whitish spots, which form about three broad bars across the throat; the sides below the dorso-lateral band are dark with numerous whitish spots; the white longitudinal stripe under the eye is conspicuous, but mostly crossed by narrow black lines radiating from the eye.

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[a] Dedicated to Prof. Kakichi Mitsukuri, of the Imperial University of Tokyo.

[b] Thus, as a rule, the nasal is smaller and separated from the supralabial by a narrow scale, while in *J. swinhonis* they are as often in contact. The percentage is not great enough to make this character available for diagnostic purposes.

For further discussion of this form see previous remarks under the genus (p. 184). I may also refer to the remarks accompanying my original diagnosis of the species, but it should be noted that the comparison there made was chiefly with the abnormal female specimen alleged to have come from Taipa and described above, p. 185.

Dimensions.—Adult male; type, U.S.N.M., No. 36505; Botel Tobago Island, May, 1899; T. Tada, collector.

	mm.
Total length	289
Snout to vent	76
Vent to tip of tail	213
Snout to center of eye	14
Greatest width of head	15
Fore leg	39
Hind leg	70

Habitat.—This form is only known from the island of Botel Tobago, where, according to Mr. Tada, it is abundant.

List of specimens of Japalura mitsukurii.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.
U.S.N.M	36505	Male[a]	Botel Tobago Island	May —, 1899	T. Tada.
Do	36506	Female	do	do	Do.
Sci. Coll. Tokyo	24 a	Male	do	do	Do.
Do	24 b	Female	do	do	Do.
Do	24 c	Male	do	do	Do.
Do	24 d	do	do	do	Do.
Do	24 e	do	do	do	Do.

[a] Type, p. 191.

Genus —— ?

Species —— ?

The young Agamoid lizard designated by Hallowell (Proc. Phila. Acad., 1860, p. 491) simply as "*Otocryptis,*" though practically admitting that it does not belong to Wiegmann's genus, is still in the museum (No. 12252). When Hallowell wrote his notes on this specimen, it was already "much mutilated and otherwise injured," and the intervening 47 years have not improved its condition. In fact, several of the characters noted by him are now obliterated. Yet, what is left seems to show that the specimen does not belong to any now recognized genus and species, and also that Hallowell's description, which I reproduce verbatim below, is fairly good.

The dentition is now the most prominent feature, the comparatively enormous tricuspid molars standing out in bold relief. They are eight in number on each side in both jaws, gradually increasing in size backward; in the upper jaw there are, besides, three "incisors," the median largest, and a small hardly differentiated "canine" on each side of these; in the lower jaw there are three conical "incisors" on each side in front of the molars, the middle tooth on each side being largest. The dental formula consequently looks like this:

$$\frac{8+1+3+1+8}{8+3+3+8}$$

For comparison I append that of the type of *Japalura polygonata:*

$$\frac{14+2+5+2+14}{14+3+3+14}$$

The small number of molars in both jaws is probably due to the youth of the specimen, as Siebenrock has shown that in some *Agamidæ* the number varies between 8 and 21, according to age,[a] but the difference in the number of incisors is not so easily explained, for it seems, according to the same authority,[b] as if the young animals have even more incisors than the adult, a condition reversed in the *Japalura* and the uncertain young Agamoid before us.

A young specimen of *Japalura swinhonis* (U.S.N.M. No. 34097), from Formosa, though more than once and a half as large as Hallowell's specimen, corroborates the above. In the upper jaw it has nine "molars," two "canines," and four "incisors," consequently essentially like the adult, only fewer molars.

Hallowell's description is as follows:

OTOCRYPTIS Weig.

> Among the saurians in the Loo-Choo collection is a very small Acrodont Iguanian, no doubt a young animal, which appears to belong to a genus very near if not identical with the Otocryptus of Weigmann. The form of the head, however, is different from that of Otocryptus, as described by Dumeril & Bibron, and the number of molar teeth is less, viz.:—eight instead of twelve. The specimen, small as it is, is much mutilated, and otherwise injured, but the following characters can be distinctly made out.
>
> *Gen. char.* Head rounded, and high posteriorly, the anterior slope more gradual than the posterior, the front and vertex being nearly on a line; snout covered with polygonal scales; supraorbitar ridges distinct; eyelids covered with carinated scales of nearly equal size; occiput covered with polygonal scales, partly smooth, partly carinate; temples covered with carinated scales; eyelids covered with small scales.

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[a] Sitz. Ber. Akad. Wiss. Wien, Math.-Naturw. Cl., CIV, Pt. 1, p. 1116 (Nov., 1895.)

[b] Idem, p. 1121.

The incisor teeth on each side separate, a conical canine and eight tricuspid, the first three the smallest, the last two the largest; the same number in the lower jaw; ears concealed by the integument; body covered with scales arranged in transverse rows; five fingers without serratures, the fourth finger a little the longest, all armed with recurved nails; tail slender.

Dimensions. Length of head 4 lines; of neck and body 6½ lines; of tail (mutilated) 10 lines; length of anterior extremities 6 lines; of posterior

Habitat. Loo-Choo. One specimen. Caught Nov. 1854, by McKnight.

In addition to Hallowell's description, I note that the scales on the sides of the neck and body appear to be very small, almost granular.

No lizard corresponding to the above description has been brought from the Riu Kius by later travelers, and the possibility is, therefore, that a most interesting novelty may yet be found in those islands.

Family SCINCIDÆ.

Lizards with scaly tongue and lower surface covered with rounded, imbricate scales.

Distributed over all the warmer and temperate regions of the globe. Many species have an enormous geographic range owing to the ease with which they may be accidentally transported.

Throughout the family there is a strong tendency toward the suppression of the limbs, and although in the higher forms they are well developed, there are numerous genera in which they become rudimentary or even disappear entirely. None of these occur in Japanese or neighboring territory, all the species here represented belonging to six genera, having the normal number of digits.

KEY TO THE GENERA OF SKINKS OCCURRING IN JAPAN AND ADJACENT TERRITORY.

a^1 Movable lower eyelid; fronto-parietals and interparietals distinct.
  b^1 Supranasals present.
    c^1 Palatine bones separated on the median line................*Eumeces*, p. 193.
    c^2 Palatine bones in contact on the median line................*Mabuya*, p. 213.
  b^2 Supranasals absent.
    c^1 Fronto-parietals in contact; dorsals smooth or weakly bicarinate; claws not retractile.
      d^1 Lower eyelid scaly ....*Sphenomorphus*, p. 216.
      d^2 Lower eyelid with an undivided transparent disk....*Leiolopisma*, p. 218.
    c^2 Fronto-parietals not in contact; dorsals tricarinate; claws retractile. *Lygosaurus*, p. 221.
a^2 No movable lower eyelid; fronto-parietals and interparietal united into a single shield ....*Cryptoblepharus*, p. 225.

Genus EUMECES[a] Wiegmann.

1834. *Eumeces* WIEGMANN, Herpet. Mex., p. 36 (type, *Scincus pavimentatus* = *E. schneiderii*).

1839. *Plestiodon* DUMÉRIL and BIBRON, Erpét. Gén., V, p. 697 (same type).

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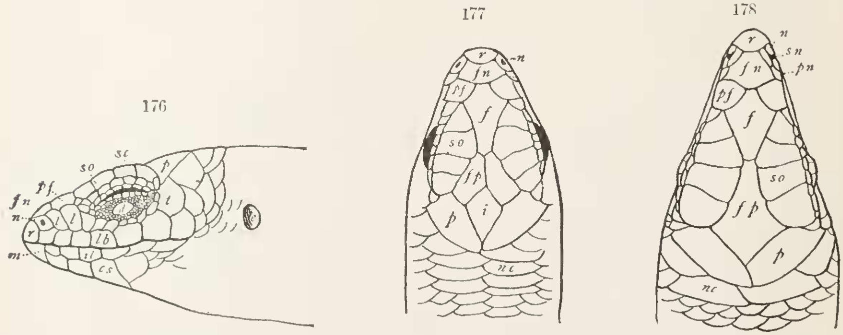
[a] From εὐμήκης, elongated.

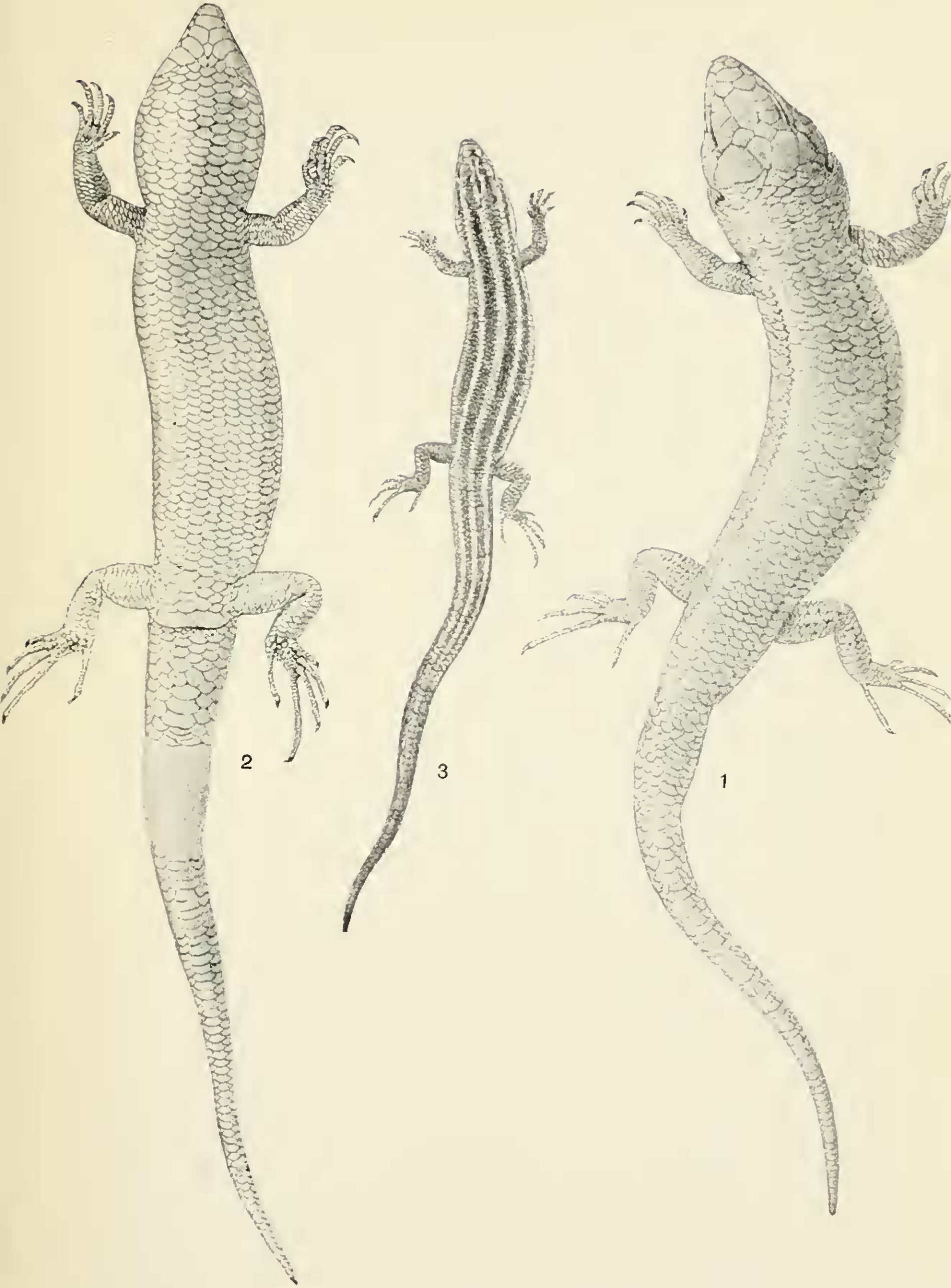
1852. *Lamprosaurus* Hallowell, Proc. Phila. Acad., 1852 (p. 206) (type, *L. guttulatus*).

1871. *Plistodon* Cope, Sec. and Third Ann. Rep. Peabody Acad., 1871 (p. 82) (emendation).

The characters relied upon in the genus *Eumeces* for the proper separation and identification of the species are unfortunately subject to a wide range of variation, at least in some of the species. Such criterions as the absence or presence of a postnasal, of one or two postmentals, the number of scales around the body, etc., are apt to fail when most needed. Yet they are the only ones which the systematist has to rely on, and though he may be convinced that he has to deal with separate forms, nevertheless he may occasionally have to fall back on locality. Take, for instance, *Eumeces elegans* of Boulenger, from China. The only character by which I can distinguish it from *E. latiscutatus*, from Japan, is by the absence of a postnasal. Yet, among sixty-two Japanese specimens examined by me, five lack the postnasal on both sides and two on one side. It does not seem to be to the best interest of science to make *E. elegans* a synonym of *E. latiscutatus*. Much less would it do to call the five Japanese specimens *E. elegans* and enumerate both species as occurring together in the island of Hondo. Very likely some of these specimens without postnasals are brothers or sisters of the others which have this shield. Moreover, what are we to do with those which have it on one side but not on the other? It would probably be a fit case for trinominals were we to find a similar proportion of postnasals present in Chinese *E. elegans*, but unfortunately we have not sufficient material of the latter to determine the point. The most conservative proceeding therefore is to leave the two forms their binominal nomenclature at least until we shall know the Chinese form better.



Figs. 176–178.—Head shields of Scincid lizards. 176, side view of head of Leiolopisma; 177, upper view of head of Leiolopisma; 178, upper view of head of Emoia. *cs*, chin-shields; *d*, disk on lower eyelid; *e*, ear-opening; *f*. frontal; *fn*, fronto-nasal; *fp*, fronto-parietal; *i*, interparietal; *il*, lower labials; *l*, loreals; *lb*, upper labials; *m*, mental; *n*, nasal; *nc*, nuchals; *p*, parietals; *pf*, prefrontal; *pn*, postnasal; *r*, rostral; *sc*, supraciliaries; *sn*, supranasal; *so*, supraocular; *t*, temporal. (All figures enlarged.)



EUMECES LATISCUTATUS. (FROM SCHLEGEL.)

FOR EXPLANATION OF PLATE SEE PAGE 554.

The use of the following key in determining the skinks within the territory covered by this work must then be subject to the above remarks. The stability of the various characters employed may best be understood by a perusal of the remarks on *variation* following the descriptions of each species.

KEY TO THE JAPANESE SPECIES OF EUMECES.

- a^1 One unpaired postmental only (normally); upper temporal of the second row largest, wedge-shaped; soles of hind feet granular with only a few large tubercles on heel.
  - b^1 Posterior loreal nearly as high as long, normally in contact with two supralabials.
    - c^1 Postnasal present (normally).
      - d^1 24 to 26 (exceptionally 28) scales round the middle of the body. *E. latiscutatus*, p. 195.
      - d^2 28 to 32 scales round the middle of the body . . . *E. latiscutatus okadæ*, p. 200.
    - c^2 No postnasal . . . . *E. elegans*, p. 202.
  - b^2 Posterior loreal much longer than high, in contact with three supralabials. *E. marginatus*, p. 205.
- a^2 Two unpaired postmentals; lower temporal of the second row largest, wedge-shaped; soles of hind feet with two series of enlarged tubercles between heel and base of third and fourth toes.
  - b^1 No postnasal; normally two pairs of nuchals. . . . . *E. chinensis*, p. 208.
  - b^2 Normally a postnasal and three pairs of nuchals. . . . . *E. kishinouyei*, p. 210.

EUMECES LATISCUTATUS[a] (Hallowell).

TOKAGE.

Plate XV.

1838. *Scincus quinquelineatus* SCHLEGEL, Fauna Japon., Rept., pp. 99, 139; Sauri et Batr., pl. I, figs. 1–4[b] (Leiden Mus.; Siebold and Buerger, collectors) (not of Linnæus).—*Plestiodon quinquelineatum* BLEEKER, Natuurk. Tijdschr. Nederland. Indië, XVI, 1858, p. 204 (Japan).—*Eumeces quinquelineatus* HILGENDORF, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 113.—FRITZE, Mitth. Deutsch. Ges. Ost.-Asiens, V, 1891, p. 239 (Yezo).

1860. *Plestiodon latiscutatus* HALLOWELL, Proc. Phila. Acad., 1860, p. 496 (type-locality, Simoda, Japan; collected by the Rodger Exped.).

1864. *Eumeces* (*Plestiodon*) *quinquelineatus* var. *japonicus* PETERS, Mon. Ber. Berlin Akad. Wiss., 1864, p. 57 (type-locality, Nagasaki; type in Berlin Mus.; von Martens, collector).—MARTENS, Preuss. Exped. Ost-Asien, Zool., I, 1876, p. 376 (Nagasaki).

1878. *Eumeces* (*Plestiodon*) *japonicus* BOETTGER, Offenbach. Ver. Naturk. 17–18 Ber., Mitth., p. 4 (Japan).

1879. *Eumeces japonicus* BOCOURT, Miss. Sci. Mexique, Rept., livr. 6, p. 423.

1887. *Eumeces marginatus* BOULENGER, Cat. Liz. Brit. Mus., III, p. 371 (part: Miyanoshta; Nikko) (not of Hallowell).—OKADA, Cat. Vert. Japan, 1891, p. 70 (part: Tokyo; Hakone; Nikko; Awaji; Suwa).—BOETTGER, Kat. Rept. Mus. Senckenberg., I, 1893, p. 111 (part: Nikko; Yezo).—FRITZE, Zool. Jahrb. Syst., VII, 1894, p. 860; author's separate, p. 11 (part: Hondo; Yezo).

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[a] Signifying with broad shields.

[b] Figs. 1, 3, 4, reproduced in this work on Plate XV.

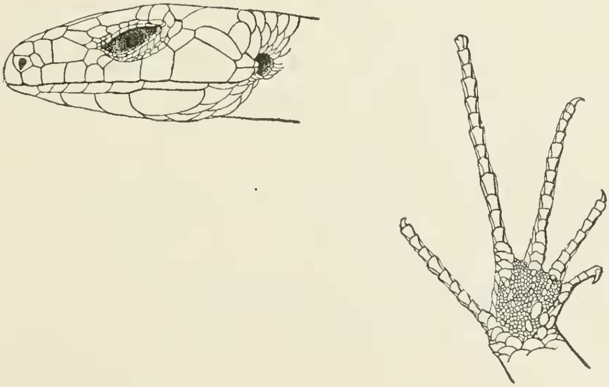
As the name *E. marginatus* belongs to the Riu Kiu species, *Eumeces latiscutatus* of Hallowell must be taken for that of Japan proper. The type appears to be lost, but there can be no doubt as to the pertinency of the name in spite of the fact that Hallowell apparently overlooked the presence of a postnasal. He describes his specimen as having "a plate above the anterior frenal," which, however, he considers an individual abnormality. The fact is that the plate alluded to is the real anterior frenal, or first loreal, while the scale he so designates is only the abnormally enlarged postnasal crowding the loreal out of contact with the supralabial. In specimens from the main islands of Japan this state of affairs is not uncommon (14 out of 47 specimens), and in extreme cases it looks at a first glance as if the postnasal were missing.

Doctor Hallowell does not state the locality in Japan where the type specimen of *E. latiscutatus* was collected, but the only entry in Dr. W. Stimpson's manuscript catalogue which can have reference to this specimen is his "Sm.—15. Lizard found on hillsides at Simoda, Japan, May, 1855. Black above, lineate with light blue. Below pale blue." Simoda may therefore be regarded as the type locality.

One may still occasionally see this species quoted as *E. quinquelineatus,* it being asserted upon Schlegel's authority that there is no difference between the Japanese and the North American species. A careful comparison will show that there exist material differences in the number of scale rows, size, and shape of rostral and nasals, size of median dorsal scales, shape of claws, etc., as already pointed out by Hallowell, Peters, and Boulenger. To their statements I may add that the two species can be very readily distinguished by the differences shown in the relative size and shape of the large temporal shields between the parietals and the seventh labial, the North American species having an arrangement very much like that of the Yaeyama species *E. kishinouyei* as distinguished from *E. marginatus, E. latiscutatus,* and their immediate allies and illustrated on figs. 179, 182, 184.

Description (figs. 179–180).—*Adult male;* U.S.N.M. No. 12715; Yokohama; April, 1881; P. L. Jouy, collector. Rostral high, bent over on the snout, the portion visible from above being nearly as large as the fronto-nasal; supranasals in contact behind rostral; nostril in the anterior portion of a single nasal, which is higher anteriorly than posteriorly; a small postnasal in contact with supranasal, nasal, first and second labials (on left side with first labial only) and anterior loreal; fronto-nasal broader than long, not in contact with rostral nor with frontal; prefrontals nearly as large as fronto-nasal in contact behind the fronto-nasal, also in contact with both loreals and with upper preocular and anterior supraocular; anterior loreal high and narrow, in contact with second supralabial (on left side also with first); posterior loreal pentagonal, nearly as high as wide, in contact with second and third supralabials; frontal as long as parietals, longer than its distance from tip of snout, anteriorly a little wider than behind, in contact with three supraoculars; four supraoculars, second largest; seven superciliaries; fronto-parietals somewhat smaller than interparietal; parietals large, in contact behind interparietal; one pair of nuchals; seven supralabials, seventh largest, fifth under the eye; two temporals in the first row, lower much the larger; upper temporal in the second row very large, much larger than lower one, wedge-shaped with the apex pointing forward; lower temporal of the second row elongate squarish, with upper and lower edges nearly parallel; a single large scale between seventh supralabial and ear-opening which is bordered anteriorly by a few projecting granules; mental small, followed by a single pentagonal, unpaired postmental; seven lower labials, the sixth being band-like, long and narrow; body covered above and below with cycloid scales in 26 rows around the middle, those on the middle of the back slightly wider than the others, laterals not essentially smaller than ventrals; a pair of large preanal plates; length of hind leg contained twice and a half times in the distance from snout to vent; the adpressed limbs overlap by the length of the fingers; sole of hind foot granular with a single larger tubercle and a few others at the heel; a specialized scale with a claw-like pointed keel behind the vent at each corner; tail cylindric, tapering, slightly swollen underneath at base, with a series of wide transverse plates on the underside. Color (in alcohol), above pale olive gray with a dorso-lateral whitish band about one scale wide, bordered below by a broad dark-brown band from the eye over the ear-opening, above the legs and continued on the tail nearly to the tip; head nearly uniform olive clay color; whole underside, including lower half of flanks, whitish, chin and throat suffused with clay color, the rest with bluish gray.

179 180



FIGS. 179-180.—EUMECES LATISCUTATUS. 2 × NAT. SIZE. 179, SIDE OF HEAD, NORMAL POSTNASAL; (2⅔ × NAT. SIZE) 180, UNDERSIDE OF HIND FOOT. NO. 6166, U.S.N.M.

Dimensions.

	mm.
Total length	186
Snout to vent	64
Vent to tip of tail	122
Snout to ear-opening	15
Greatest width of head	12
Axilla to groin	34
Fore leg	18
Hind leg	25

The *female* differs in lacking the swelling at the base of the tail and apparently also the differentiated keeled scale behind each corner of the vent.

The *younger* individuals differ in not having the temporal region swollen and also differ greatly in color. As exemplified by a large series from Mount Fuji, they are (in alcohol) nearly blackish brown above, becoming dark brownish slate on the terminal half of the tail, with five pale longitudinal stripes, viz, one median; one on each side proceeding from the outer edge of the supraoculars down the sides of the back, two scale widths from the median stripes; finally, a lateral stripe on each side originating on the supralabials, through the ear and above both fore and hind legs; all continued on the tail where they gradually disappear; the median stripe bifurcates on the interparietal, each branch following the outer edge of the frontal to the snout, which is pale brownish; underside bluish gray, except chin, throat, limbs underneath, anal plate, and the subcaudal transverse plates, which are pale buff. According to Stimpson they are black in life with light blue stripes and pale blue underside.

Variation.—There is considerable variability in the head scales and their various relations, but as it would be of little use to note all the deviations from the specimen described above, it will be sufficient to call attention to those which are of systematic value.

Out of 62 specimens examined by me only one (No. 34123) has the azygous postmental divided, and the abnormality of the specimen is further shown by a small portion of the side of the posterior postmental being also separated by a suture.

In 3 specimens (Nos. 34120, 34130, 34138) the posterior loreal is in contact with three supralabials on both sides; in one (No. 30734) on one side only, and in one (No. 34126) it barely touches the third labial on one side.

Five specimens (Nos. 34119, 34121, 34126, 34127, 34133) have no postnasal at all; two lack it on one side only (Nos. 34128, 34139), while in 37 specimens it is present on both sides.

Curiously enough the variation in the postnasal is most pronounced in a single series of specimens collected near Mount Fuji in September, 1898. Out of the 21 specimens five have no postnasals at all, two on one side only, and of the fourteen others which have it on both sides, no less than nine have the postnasal so large as to crowd the anterior loreal away from the supralabials, so that only in five does it come in contact with the supralabials behind the postnasal and that not even always on both sides.

Of 39 specimens, the only ones examined for this character, the scale rows around the middle of the body are 28 in two only, 26 in twenty-four, and 24 in thirteen.

Habitat.—Apparently confined to the large islands of Japan proper. The types came from the hills back of Simoda, and the species is apparently quite common in that part of Hondo. We have a large number from around Mount Fuji and from Yokohama; British Museum has it from Miyanoshta and Nikko, whence specimens are also in the Senckenberg Museum, and Okada records it from Tokyo and Hakone. From farther south the latter also indicates the provinces of Awaji and Suwa; the Hamburg Museum has it from Kiyotaki toge in the province of Kawachi (No. 1833), and the United States National Museum from Koriyama, province of Yamato. From northern Hondo there are no records. From Yezo, however, there is said to be a specimen in the Senckenberg Museum received from Mr. B. Schmacker,[a] and Doctor Fritze also indicates it from that island, without giving his authority, however. If occurring there, it must be rare or local. Dr. Hugh M. Smith brought us a fine series from Kochi, on Shikoku, the only record from that island. He also collected it in the extreme southern end of Kiusiu at Yamagawa, province of Satsuma. Our museum also has it from Miyazaki, and von Martens obtained it at Nagasaki, from which locality the Riksmuseum in Stockholm also has a specimen (No. 2319), collected by Dr. Oscar Nordquist in October, 1879, during the *Vega* expedition.

List of specimens of Eumeces latiscutatus.

U.S. N.M. No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Postmentals.	Postnasal.
6166a	(a)	Japan				1	1
6166b		do.				1	1
6166c		do.				1	1
6166d		do.				1	1
6166e		do.				1	1
12715	(b)	Yokohama	Apr., 1881	Dale and Jouy	26	1	1
13750		do.		P. L. Jouy		1	1
30734		Miyazaki, Kiusiu		C. A. Clark	24	1	1
31804		Koriyama, Yamato	Apr. 26, 1903	H. M. Smith	26	1	1
31832		Yamagawa, Kiusiu	June 14, 1903	do	24	1	1
31833		do.	do	do	26	1	1

[a] Figs. 179-180.

[b] Description, p. 196.

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[a] See, however, remarks on alleged Yezo specimens by the same collector, pp. 111, and 275.

List of specimens of Eumeces latiscutatus—Continued.

U.S. N.M. No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Postmentals.	Postnasal.
31834	......	Yamagawa, Kiusiu	June 14, 1903	H. M. Smith	26	1	1
31835	......	do.	do.	do.	26	1	1
31836	......	do.	do.	do.	26	1	1
31837	......	do.	do.	do.	26	1	1
31879	......	Kochi, Shikoku	May 11, 1903	do.	26	1	1
31880	......	do.	do.	do.	26	1	1
31881	......	do.	do.	do.	26	1	1
31882	......	do.	do.	do.	26	1	1
31883	......	do.	do.	do.	26	1	1
31890	......	do.	do.	do.	26	1	1
31891	......	do.	do.	do.	24	1	1
31892	......	do.	do.	do.	28	1	1
31893	......	do.	do.	do.	28	1	1
34119	......	Mount Fuji	Sept., 1898	A. Owston	24	1	0
34120	......	do.	do.	do.	26	1	1
34121	......	do.	do.	do.	24	1	0
34122	......	do.	do.	do.	24	1	1
34123	......	do.	do.	do.	26	2	1
34124	......	do.	do.	do.	24	1	1
34125	......	do.	do.	do.	24	1	1
34126	......	do.	do.	do.	26	1	0
34127	......	do.	do.	do.	24	1	0
34128	......	do.	do.	do.	26	1	1-0
34129	......	do.	do.	do.	26	1	1
34130	......	do.	do.	do.	26	1	1
34131	......	do.	do.	do.	24	1	1
34132	......	do.	do.	do.	26	1	1
34133	......	do.	do.	do.	26	1	0
34134	......	do.	do.	do.	26	1	1
34135	......	do.	do.	do.	24	1	1
34136	......	do.	do.	do.	26	1	1
34137	......	do.	do.	do.	24	1	1
34138	......	do.	do.	do.	24	1	1
34139	......	do.	do.	do.	26	1	1-0

EUMECES LATISCUTATUS OKADÆ,[a] new subspecies.

Diagnosis.—Scales round the body 28–30; first upper labial forming a suture with the nasal and the postnasal; a single postmental.

Habitat.—Miyakeshima, Idzu Seven Islands, Japan (not to be confounded with Miyakoshima, Yaeyama Islands).

Type.—U.S.N.M. No. 23891; Miyakeshima; May 3; N. Okada, collector; topotypes in Science College Museum, Tokyo.

Description of type-specimen.—Rostral heptagonal, rather high, and broad at top, though not bent much over on the upper surface; nasal small with the nostril pierced in front of the center; a small postnasal in contact with first and second supralabial (fig. 181);

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[a] Named for Mr. S. Okada, the author of the Catalogue of Vertebrated Animals of Japan (Tokyo, 1891).

NOTES ON THE SURFACE COPEPODA OF THE GULF OF MANNAR.

By Captain R. B. Seymour Sewell, B.A., I.M.S.

Surgeon-Naturalist to the Marine Survey of India and Honorary Assistant Superintendent, Zoological and Anthropological Section, Indian Museum, Calcutta.

(With five Plates and one Map.)

THE collections on which the following notes are based are two in number. The first of these is a very extensive one from the Ceylon pearl banks and neighbouring waters. This collection was made by Mr. T. Southwell during the years 1906–09, when he was Scientific Adviser to the Ceylon Pearl Fishery Syndicate, and comprises 326 samples ; at the time when the Syndicate ceased its operations, this collection was handed over to Dr. J. Pearson, the Director of the Colombo Museum, and I have to thank him for entrusting it to me for examination. The second collection was made by Mr. S. W. Kemp, of the Indian Museum, during the month of February, 1913, at Paumben and Kilakarai on the south coast of India. The collections proved to be exceedingly rich, containing in all 87 species and varieties, of which five are new to science, namely, *Acrocalanus similis*, *Scolecithricella pearsoni*, *Centropages trispinosus*, *Acartia southwelli*, *Acartiella kempi*, gen. nov. ; and in addition I am able to record the occurrence of the following hitherto unknown forms :—*Eucalanus mucronatus*, ♂ ; *Labidocera pavo*, ♂ ; *Acartia amboinensis*, ♀ ; *Tortanus forcipatus*, ♂.

In the accompanying table I have given a complete list of the various species and varieties, and have indicated by + the various localities in which they were present. For the most part the species are widely distributed, but it is of interest to note that the species of the genera *Euchæta*, *Scolecithrix*, *Scolecithricella*, and *Candacia* appear to be very largely confined to the region of the pearl banks lying to the west of Karativu island, between it and the overfalls, including

Dutch Moderagam, Karativu, and Alanturai paars, all of which localities proved to be exceedingly rich as regards the Copepod fauna.

The positions of the various localities in which collections were made are shown on the chart, but in the case of many of the paars they are approximate only.

Family, CALANIDÆ.

Genus **Calanus**, Leach.

CALANUS MINOR (Claus.).

* *Calanus minor*, Giesbrecht, 1888, p. 331.
——— Giesbrecht, 1891, p. 282.
——— Cleve, 1901, p. 5.
——— A. Scott, 1902, p. 422.
——— Thompson & Scott, 1903, p. 241.
——— Wolfenden, 1905, p. 995.
? *Calanus caroli* (♀), Wolfenden, 1905, p. 994.
Calanus minor, Cleve, 1905, p. 186.
——— A. Scott, 1909, p. 7.
——— Sewell, 1912, p. 354.
Undinula caroli (♀), Sewell, 1912, p. 356.
Calanus minor, Pesta, 1913, p. 30.

This species is comparatively rare on the pearl banks, and is absent altogether in the majority of tow-nettings. Most of the specimens obtained were females. Wolfenden (1905) obtained a female calanid, of which he gives neither a full description nor any figures, from the Maldive and Laccadive Archipelagoes: he believed this form to be the hitherto-unknown female of *Undinula* (*Calanus*) *caroli*, Giesbrecht. I obtained what appeared to be similar examples from the Burma coast, but a subsequent examination showed that they were in reality examples of *Calanus minor*, and, as I have pointed out below (p. 199), there seems to be some reason for believing that *Undinula caroli* is merely a variety of *Undinula darwini*, Giesbrecht (♂).

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* In the majority of cases the list of references only includes those that refer to the occurrence of the species in Indian waters.

CALANUS TENUICORNIS, Dana.

Calanus tenuicornis, Cleve, 1904, p. 186.
——————— A. Scott, 1909, p. 8.

This species was represented by a single female taken near Karativu Paar. Its occurrence is of some interest, as it is the first occasion on which it has been recorded from Indian coastal waters.

Genus **Canthocalanus,** A. Scott.

CANTHOCALANUS PAUPER (Giesbrecht).

Calanus pauper, Thompson, 1899, p. 275.
——————— Cleve, 1901, p. 5.
——————— A. Scott, 1902, p. 400.
——————— Cleve, 1903, p. 357.
——————— Thompson & Scott, 1903, p. 241.
——————— Wolfenden, 1905, p. 995.
Canthocalanus pauper, A. Scott, 1909, p. 9.
Calanus pauper, Pesta, 1912, p. 43.
Canthocalanus pauper, Sewell, 1912, pp. 315 and 355.
Calanus pauper, Pesta, 1913, p. 30.

CANTHOCALANUS PAUPER, var. PLUMULOSUS, Wolfenden.

Canthocalanus pauper, var. *plumulosus*, Sewell, 1912, p. 355.

This species was universally distributed over the pearl banks and neighbouring waters, occurring at times in large numbers. Wolfenden (*loc. cit.*, p. 994, 1905) has called attention to a curious modification of the furcal setæ which is occasionally met with in *Undinula vulgaris*, *Paracalanus aculeatus*, *Calocalanus pavo*, and *Euchirella bella* var. *indica*. This modification consists of " a more or less dichotomous branching, repeated in the sub-branches, the whole forming a sort of brush," and he has proposed that examples showing this character should be considered as a variety under the name "*plumulosus.*" I have previously (*loc. cit.*, pp. 355, 357, and 359) recorded a similar modification in *Canthocalanus pauper*, *Undinula caroli*, and *Acrocalanus longicornis*.

Numerous specimens, both of the above species and of *Undinula vulgaris*, showed this peculiarity, and a study of these examples has caused me to alter my opinion. I am inclined to regard this branching of the setæ merely as an abnormality and not a true variety. In the tables below I have given the results obtained from an examination of the furcal setæ of a series of individuals of these two species, in which this peculiarity was present to a greater or less degree; in all cases the seta showing the modification is indicated by +.

Canthocalanus pauper.

No. and Sex.		Left Furca.					Right Furca.					
		5	4	3	2	1	1	2	3	4	5	
1	♂	.	.	.	+	.	.	+	.	.	.	Average number of setæ affected in ♂, 2·3.
2	♂	.	.	.	+	.	.	.	.	+	.	
3	♂	.	.	.	.	.	.	+	+	.	.	
4	♂	.	.	.	+	.	.	.	.	.	.	
5	♂	.	+	+	+	.	.	+	+	.	.	
6	♂	.	+	+	+	.	.	+	+	.	.	
7	♂	.	.	.	.	.	+	.	.	.	.	
8	♂	.	.	.	.	.	.	+	+	.	.	
9	♂	.	.	.	+	.	.	.	.	.	.	
10	♀	.	+	+	+	.	+	+	+	.	.	Average number of setæ affected in ♀, 5·1.
11	♀	.	+	+	+	.	+	+	+	.	.	
12	♀	.	+	+	+	+	+	.	+	.	.	
13	♀	.	+	+	+	.	.	+	+	+	+	
14	♀	.	.	+	+	+	+	+	+	.	.	
15	♀	.	.	.	.	.	.	+	.	.	.	
16	♀	.	+	+	+	.	.	+	+	.	.	
17	♀	.	+	+	+	.	.	+	+	+	.	
18	♀	.	+	+	+	+	.	+	+	.	.	
19	♀	.	+	+	+	.	.	+	+	.	.	
20	♀	.	.	+	+	.	.	.	.	.	.	
Number of times each seta is affected		0	10	12	16	3	5	14	13	3	1	

Undinula vulgaris.

No. and Sex.		Left Furca.					Right Furca.					
		5	4	3	2	1	1	2	3	4	5	
1	♂	.	.	.	.	.	.	.	.	+	.	Average number of setæ affected, 3·7.
2	♂	.	.	.	.	+	.	.	.	.	.	
3	♂	.	.	.	+	+	.	.	.	.	.	
4	♂	.	.	+	+	.	+	+	.	.	.	
5	♂	.	+	+	+	+	+	+	+	+	.	
6	♂	.	.	.	+	+	+	+	+	+	.	
7	♀	+	+	+	+	.	.	+	+	.	.	With spermatophores, average number of setæ affected, 4·3.
8	♀	.	+	.	.	.	.	.	.	.	.	
9	♀	.	.	.	+	+	.	.	+	.	.	
10	♀	.	+	+	+	+	+	+	+	+	.	
11	♀	.	.	.	+	+	+	.	+	.	.	
12	♀	.	+	+	+	+	+	+	.	.	.	
13	♀	.	.	+	+	+	+	+	+	.	.	
14	♀	.	.	+	+	+	+	+	.	.	.	
15	♀	.	.	.	+	.	.	.	.	.	.	
16	♀	.	+	.	.	.	.	.	.	.	.	
17	♀	.	.	+	+	.	.	+	+	+	.	
18	♀	.	+	+	+	+	+	+	+	.	.	
19	♀	.	.	+	.	.	.	.	.	.	.	
20	♀	.	.	+	.	.	.	.	.	.	.	
21	♀	.	.	.	.	+	+	+	+	+	.	
22	♀	+	.	.	.	+	.	+	.	.	.	
23	♀	.	.	.	.	.	.	+	.	+	.	
24	♀	+	+	+	+	+	+	+	.	.	.	
25	♀	.	.	.	.	.	.	+	+	+	.	
26	♀	.	+	+	+	+	.	.	.	.	.	
27	♀	+	+	+	+	.	+	+	+	+	.	
28	♀	.	+	+	+	+	+	+	+	+	.	
29	♀	.	.	.	.	.	.	+	.	.	.	Without spermatophores, average number of setæ affected, 2·2
30	♀	.	.	.	.	+	+	+	+	.	.	
31	♀	.	+	.	.	+	+	.	.	.	.	
32	♀	.	.	.	.	.	.	+	.	.	.	
Number of times each seta is affected		4	12	15	18	18	15	20	14	10	.	

From the above it is evident that there is little or no regularity in the disposition of the plumose setæ in any particular individual, in some cases only a single hair showing this change, in others all ten doing so; it is quite exceptional to find any attempt at symmetry in the arrangement. It will be noticed that in the number of individuals affected, the proportion of females is larger than that of males, but a difference such as this might easily be accounted for by the greater preponderance of females in the catch.

With regard to the total number of hairs affected and their relative position, it is quite clear that on the whole far more setæ are abnormal in the female than in the male, and, further, the setæ most frequently affected are those that possess the greatest length, *i.e.*, numbers 2, 3, and 4.

I have on one occasion found a similar " plumose " seta arising from the tip of a damaged antenna in an example of *Acrocalanus longicornis.* In this case the antenna had obviously been damaged on some previous occasion, the terminal segments being broken off ; subsequently the stump had healed, and from the scar this seta had arisen.

I am of the opinion that this plumose modification is an abnormality produced by injury to, and subsequent regeneration of, the seta, and, further, the prevalence of this change in spermatophore-bearing females of *Undinula vulgaris* would tend to show that the injury is frequently caused during the act of deposition of the spermatophore by the male.

Genus **Undinula,** Scott.

UNDINULA VULGARIS (Dana).

(Pl. XVII., figs. 1 and 2.)

Calanus vulgaris, Giesbrecht, 1896, p. 318.
——— Thompson, 1899, p. 275.
——— Cleve, 1901, p. 5.
——— A. Scott, 1902, p. 400.
——— Thompson & Scott, 1903, p. 357.
——— Cleve, 1903, p. 357.
——— Cleve, 1904, p. 186.
——— Wolfenden, 1905, p. 994.
Undinula vulgaris, A. Scott, 1909, p. 16.
——— Sewell, 1912, pp. 315 and 356.

Calanus vulgaris var. *plumulosus*, Wolfenden, 1905, p. 994. Pl. XCVI., figs. 21, 22.

Undinula vulgaris var. *plumulosus*, Sewell, 1912, p. 356.

This species was widely distributed throughout the regions investigated. Numerous examples were obtained showing the modified tail setæ as described by Wolfenden (*vide ante*, p. 193), but, as I have already pointed out, I do not consider this condition to be a true variation.

Several examples were obtained which show the double spine on the left side of the posterior thoracic margin. This modification was first described by Giesbrecht (1893, Pl. VII., fig. 28). I have since obtained specimens from the east side of the Bay of Bengal, in the neighbourhood of the Andaman Islands and Mergui Archipelago, in which this condition is even more pronounced. In these specimens the left side of the thoracic margin is considerably swollen, and forms a stout prominence projecting outwards and backwards, and bears two stout spines—the dorsal projecting backwards and somewhat upwards, and the ventral pointing vertically downwards and being considerably swollen at its base.

We thus have three forms, which appear to be quite distinct from one another, for I have up to the present failed to discover any intermediate forms.

UNDINULA DARWINI (Lubbock).

Calanus darwini, Thompson, 1899, p. 275.
———— Cleve, 1901, p. 5.
———— A. Scott, 1902, p. 400.
———— Thompson & Scott, 1903, p. 241.
———— Cleve, 1903, p. 357.
———— Cleve, 1904, p. 185.
———— Wolfenden, 1905, p. 994.
Undinula darwini, A. Scott, 1909, p. 17.
———— Sewell, 1912, p. 356.
———— Pesta, 1913, p. 30, fig. 13.

This species was much less common in the Ceylon collections than the preceding, though it is of frequent occurrence in other parts of the Indian Ocean. According to Giesbrecht (1893, Pl. VII., fig. 29), both first and second abdominal segments are furnished with a row of sharp spines on the posterior margin, and the posterior thoracic margin on the left side is produced backwards in a rectangular projection; but a study of numerous examples from various localities in the Indian Ocean and Bay of Bengal has shown that these characters are subject to very considerable variation. As regards the spinulation of the abdominal segments, many specimens possessed spines only on one of the segments, while in some cases spines were absent altogether. Again, in numerous examples the posterior thoracic margin formed almost a uniform curve, with a very slight rounded projection towards the ventral side; in other cases this prominence was more marked and formed a somewhat triangular prominence, while in a few cases the typical projection was present.

In this species, as in *U. vulgaris*, it would appear that there are three forms of the posterior thoracic margin, which are quite distinct from one another, and a close examination of a large number of specimens has failed to show any correlated change.

UNDINULA DARWINI, var. CAROLI (Giesbrecht).

Calanus caroli, Giesbrecht, 1888, p. 331.
———— Giesbrecht, 1893, p. 91. Pl. VIII., fig. 36.
———— ♂, Wolfenden, 1905, p. 994. Pl. XCVII., fig. 41.
Undinula caroli, A. Scott, 1909, p. 18.

This form was first described by Giesbrecht (*loc. cit.*, 1888), who considered that it was a distinct species. Wolfenden (*loc. cit.*, 1905) obtained examples from the Maldive and Laccadive Archipelagoes, and associated with these were several females, which he considered to be the hitherto-unknown female. According to his brief description these forms were distinguished from the female *Undinula darwini* by the absence of teeth on the distal portion of the margin of exopod 3 in the second and third pairs of swimming feet, and by the presence of a few fine spines on the first basal of the first pair. The absence of the marginal teeth separates these females from the present form, in which these teeth invariably occur exactly as in *U. darwini*, and the fine spines on the first basal of the first leg is a character that I have found present in *Calanus minor.* As I have previously mentioned (*vide ante*, p. 192), I consider that these forms are in all probability examples of *Calanus minor*.

As A. Scott (*loc. cit.*) has pointed out, the form known as *U. caroli* ♂ is easily recognizable from *U. darwini* ♂ by its constantly smaller size and by the structure of the fifth pair of legs.

In a tow-netting taken at " Investigator " Station No. 470 (Sawi Bay, Kar Nicobar, December 7, 1912), large numbers of both forms were present, associated with numerous examples of *Undinula darwini* ♀; a comparative study of the two forms of male has given the following interesting results.

The proportional lengths of the abdominal and furcal segments in the two forms are—

Undinula darwini : 45 : 41 : 32 : 27 : 25 : 23.
Undinula caroli : 45 : 41 : 31 : 27 : 24 : 22.

The proportional lengths of the antennal joints are as follows :—*

Segments :	1–2.	3–5.	6.	7.	8–9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
U. darwini	121	82	26	27	40	26	31	38	46	46	49	49	51	53	57	46	46	51	51	46	18
U. caroli	118	79	24	26	39	28	30	37	45	45	50	50	51	53	56	47	47	53	53	50	19

The structure of the first four pairs of swimming legs is exactly similar in the two forms, not only as regards the spinulation, but also in the proportional lengths of the various segments ; thus the proportional lengths of the segments and end spine in the third leg of the two forms are as follows :—

	U. darwini.	*U. caroli.*
First Basal	17·9	17·9
Second Basal	8·7	8·3
Exopod 1	11·0	11·0
Exopod 2	15·0	14·5
Exopod 3	28·9	30·0
End spine	18·5	18·3
Total length	100·0	100·0

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* In all cases the total length of the antenna has been taken = 1,000. In this way it is found that comparison between specimens of unequal size is greatly facilitated.

As a result of a careful study, it appears that the sole appreciable difference between these forms lies in the structure of the fifth pair of legs. The question then arises, Are we justified in considering these forms to be distinct " species " ?

Examples of variation in the structure of the sexual appendages have been described in other species, *e.g.*, *Labidocera kröyeri* (Brady) ; and the similarity of the two forms is so close, even to the lengths of the antennal segments and the proportions of the swimming feet, that I submit we could only get such a close resemblance in individuals of the same species, and I believe that the form described by Giesbrecht under the name *Calanus caroli* is merely a variation of the male of *Undinula darwini*.

Genus **Eucalanus,** Dana.

EUCALANUS ATTENUATUS (Dana).

Eucalanus attenuatus, Thompson, 1899, p. 276.
——————— Cleve, 1901, p. 6.
——————— Cleve, 1903, p. 362.
——————— Thompson & Scott, 1903, p. 242.
——————— Wolfenden, 1903-06, p. 996.
——————— Cleve, 1904, p. 189.
——————— Sewell, 1912, p. 357.

A few examples occurred in the collection from the pearl banks.

EUCALANUS SUBTENUIS, Giesbrecht.

Eucalanus subtenuis, Cleve, 1901, p. 7.
——————— Scott, 1902, p. 401.
——————— Cleve, 1903, p. 363.
——————— Thompson & Scott, 1903, p. 242.
——————— Wolfenden, 1903–06, p. 996.
——————— Cleve, 1904, p. 190.
——————— Scott, 1909, p. 21.
——————— Sewell, 1912, p. 358.

This species was on the whole well represented in the collections.

EUCALANUS MUCRONATUS, Giesbrecht.

Eucalanus mucronatus, Cleve, 1901, p. 7.
——————— Cleve, 1903, p. 362.
——————— Cleve, 1904, p. 189.
——————— Wolfenden, 1905, p. 996.
——————— Scott, 1909, p. 20.

Several examples of this species were obtained, although it was by no means common. Hitherto only the female form has been known, but in a tow-netting from Dutch Moderagam Paar, associated with several females was a single male specimen, that shows the following characters :—

♂. Total length, 3·3 mm.

The proportions of the cephalothorax and abdomen are as 7 : 1. The head and first thoracic segments are fused, but the fourth and fifth thoracic segments are separate. The anterior extremity of the head region is produced in a spike, as in the female.

The abdomen consists of four segments, of which the second and third are slightly longer than the first, and the anal segment is quite short. The furcal setæ are asymmetrical, the second seta on the left side being much longer and stouter than the others.

The first antennæ are long, over-reaching the tip of the furcal rami by the last five or six segments. The proportional lengths of the various segments are as follows, and for purposes of comparison I give the lengths of the segments in the female :—

Segments :	1–2.	3.	4.	5.	6.	7.	8–9.	10.	11.	12.	13.
♀. ..	123	25	25	25	25	29	50	34	34	39	43
♂. ..	69 69	24	24	24	24	26	52	38	38	48	52

Segments :	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
♀. ..	45	49	49	49	53	53	49	49	41	41	29	41
♂. ..	52	53	52	52	48	48	41	41	32	38	27	38

In the main the proportions of the joints are very much the same, the principal differences being the fusion of segments 1 and 2 in the female, and the short 22nd segment in the male.

The second antenna, mouth parts, and *the first four pairs of swimming legs* are similar to those of the female.

The fifth swimming legs are of interest, in that both are present, thus resembling the condition found in *E. attenuatus* (Dana) and *E. elongatus.* The left leg is the longer, and when folded back reaches to the extreme tip of the furcal rami ; the right leg is somewhat stouter, and the terminal segment bears a stout seta.

An immature male was also obtained in the same locality. In this individual the abdomen consists of three segments only, the third not yet having undergone division. Both legs of the fifth pair were present, but were equal in size.

EUCALANUS PILEATUS, Giesbrecht.

Eucalanus pileatus, Thompson & Scott, 1903, p. 242.
———— Cleve, 1904, p. 189.
———— Wolfenden, 1905, p. 996.
———— A. Scott, 1909, p. 21.
———— Sewell, 1912, p. 357.

Only a few examples of this species were obtained.

EUCALANUS MONACHUS, Giesbrecht.

Eucalanus monachus, Cleve, 1901, p. 6.
———— Cleve, 1903, p. 362.
———— Thompson & Scott, 1903, p. 242.
———— Cleve, 1904, p. 189.
———— Wolfenden, 1905, p. 996.
———— A. Scott, 1909, p. 20.
———— Sewell, 1912, p. 357.

This species was fairly well represented in the collections.

EUCALANUS CRASSUS, Giesbrecht.

Eucalanus crassus, Cleve, 1901, p. 6.
———— Scott, 1902, p. 401.
———— Cleve, 1903, p. 362.

Eucalanus crassus, Thompson & Scott, 1903, p. 242.
—————— Cleve, 1904, p. 189.
—————— Wolfenden, 1905, p. 996.
—————— Scott, 1909, p. 19.
—————— Sewell, 1912, p. 357.

Numerous examples were obtained.

EUCALANUS SUBCRASSUS, Giesbrecht.

Eucalanus subcrassus, Giesbrecht, 1888, p. 334.
—————— Giesbrecht, 1891, p. 282.
—————— Giesbrecht, 1896, p. 317.
—————— Cleve, 1903, p. 242.
—————— Thompson & Scott, 1903, p. 242.
—————— Cleve, 1904, p. 190.
—————— Wolfenden, 1905, p. 996.
—————— Scott, 1909, p. 21.
—————— Sewell, 1912, p. 358.
—————— Pesta, 1912, p. 44, fig. 3.
—————— Pesta, 1913, p. 31.

Examples of this species were common ; it appears to be widely distributed throughout the Indian Ocean and its offshoots.

Genus **Rhincalanus**, Dana.

RHINCALANUS GIGAS, Dana.

Rhincalanus cornutus, Thompson, 1899, p. 276.
—————— Cleve, 1901, p. 8.
—————— A. Scott, 1902, p. 402.
—————— Thompson & Scott, 1903, p. 242.
—————— Cleve, 1903, p. 368.
—————— Cleve, 1904, p. 196.
—————— Wolfenden, 1905, p. 996.
—————— A. Scott, 1909, p. 23.
—————— Sewell, 1912, p. 358.

Although widely distributed in Indian waters, this species is by no means common in surface collections. A few examples were obtained on the pearl banks.

RHINCALANUS GIGAS, Brady.

(?) *Rhincalanus gigas*, Thompson, 1899, p. 276.
Rhincalanus nasutus, A. Scott, 1902, p. 401.
——————— Cleve, 1903, p. 368.
——————— Thompson & Scott, 1903, p. 242.
——————— Cleve, 1904, p. 196.
——————— Wolfenden, 1905, p. 996.
Rhincalanus gigas, A. Scott, 1909, p. 24.

There is some doubt whether *Rhincalanus gigas*, Brady, and *Rhincalanus nasutus*, Giesbrecht, are synonymous. The differences that distinguish them are, apart from size, which *per se* cannot be regarded as a specific character, of a trivial character, and I am inclined to agree with Scott (*loc. cit.*, 1909) that they are merely forms of one species. Several examples of the form corresponding to *R. nasutus* were obtained on the pearl banks.

Genus **Mecynocera**, Thompson.

MECYNOCERA CLAUSI, Thompson.

Mecynocera clausi, A. Scott, 1902, p. 422.
——————— Cleve, 1903, p. 364.
——————— Thompson & Scott, 1903, p. 242.
——————— A. Scott, 1909, p. 25.

Although by no means common, several examples were obtained, all of which proved to be females.

Genus **Paracalanus**, Boeck.

PARACALANUS ACULEATUS, Giesbrecht.

Paracalanus aculeatus, Giesbrecht, 1888, p. 333.
——————— Giesbrecht, 1891, p. 282.
——————— Giesbrecht, 1893, p. 164. Pl. IX., figs. 20, 26, 30.
Paracalanus parvus, T. Scott, 1894, p. 26. Pl. I., figs. 9–14.
Paracalanus aculeatus, Dahl, 1894, p. 12.

Paracalanus aculeatus, Giesbrecht, 1896, p. 318.
——— Giesbrecht & Schmeil, 1898, p. 24.
——— Cleve, 1901, pp. 8 and 47. Pl. VI., figs. 1–10.
Acrocalanus pediger (♂ only), Cleve, 1901, p. 35. Pl. I., figs. 15–20.
Paracalanus aculeatus, A. Scott, 1902, pp. 402 and 423.
——— Cleve, 1903, p. 366.
——— Cleve, 1904, p. 194.
——— Wolfenden, 1905, p. 998. Pl. XCVI., figs. 12–15.
——— Sars, 1905, p. 2.
Paracalanus clevei, Carl, 1907, p. 7.
Paracalanus aculeatus, A. Scott, 1909, p. 26.
——— Pesta, 1912, p. 44, fig. 4.
——— Sewell, 1912, pp. 326 and 358.
——— Pesta, 1913, p. 31.

As the above synonymy sufficiently indicates, considerable confusion has arisen as regards this species, which was first described by Giesbrecht in 1888 from the female only.

The first record that I can find in the literature of the occurrence of male examples is that by Dahl (1894), but gives no description or figures. Cleve (1901) in the account of his investigations on the Malayan Plankton describes a male form, but from his description it is quite obvious that the specimens before him were immature, and had not adopted the final sexual characters. In the same paper, however, he has described a new species of *Acrocalanus* under the name *A. pediger*. In his description he gives a detailed account of the structure of both male and female forms, and his conclusion, that they are specifically the same, appears to have been accepted. To Carl (1907) belongs the credit of being the first to recognize that the two sexes described by Cleve do not belong to one another, that whereas the so-called female (*vide infra*, p. 211) belongs to the genus *Acrocalanus*, the male is undoubtedly a *Paracalanus ;* he, therefore, separates this latter sex and proposes for it the name *Paracalanus clevei*. During my investigations on the Copepoda of the coast of Burma and on the present collections from the Gulf of Mannar, I have met with numerous examples of this male form, and a study of its structure has convinced me that it is the true male of *P. aculeatus*.

I give below a description of these individuals :—

♂. Total length, 1·2 mm.

The abdomen and cephalothorax have the relative proportions 1 : 2·6. The head and first thoracic segments are fused, as are also the fourth and fifth thoracic segments, though in the latter region traces of the original line of division are distinctly visible ; the posterior thoracic margin is rounded.

The abdomen consists of five segments, having, with the furca, the following proportional lengths :—

13 : 27 : 20 : 19 : 17 : 12.

The furcal rami are symmetrical, and the proportions of length to breadth are 12 : 9.

The First Antenna.—As in the case of the adult male of *P. parvus,* so here also we find that the basal segments of the antenna become fused together into three joints—the first and second, the third to the sixth, and the seventh and eighth segments respectively being fused. The proportional lengths of the joints are as follows :—

Segments :	1–2.	3–6.	7–8.	9.	10.	11.	12.	13.	14.	15.
	117	157	68	20	26	28	31	40	40	40

Segments :	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
	43	43	46	46	46	46	43	49	40	31

The antenna when folded back only reaches to the end of the abdomen.

Second Antenna.—This appendage exactly resembles those of the sexually mature males of *P. parvus* (*vide* Giesbrecht, 1893, Pl. IX., fig. 23) and *P. serratipes* (*vide* Sewell, 1912, Pl. XV., fig. 7). As I have already pointed out, the nipple-like termination of the exopodite is a sexual character developed in adult males in the three genera *Paracalanus, Acrocalanus,* and *Peizocalanus* (*loc. cit.*, 1912, p. 336).

The mouth parts are similar to those of other adult males of the same genus.

The First Pair of Legs.—Basal 1 bears a single seta on its inner border, and is devoid of any spines either on its surfaces or the external margin.

Basal 2 bears the usual S-shaped seta on its distal inner border, and is likewise devoid of spines.

Exopod 1 bears a single inner seta and has no marginal spine.

Exopod 2 has a single inner seta and bears a short transverse row of needle-like spines on the outer margin.

Exopod 3 has four inner setæ : the usual two marginal spines are present, and in addition there is a row of three or four teeth on the proximal part of the outer border. The end spine is long and slender, being nearly as long as the whole exopodite.

The endopodite is two-jointed, and reaches to the level of the joint between exopods 2 and 3.

The Second Pair of Legs.—Basal 1 bears a single inner seta and no spines.

Basal 2 has no spines or setæ.

Exopod 1 has a well-developed marginal spine, and bears in addition a transverse row of sharp spinules on its outer and posterior aspect. There is a single inner seta.

Exopod 2 bears a marginal spine, and in addition has a row of six curved claw-like spinules on its outer margin, and three triangular spines on its anterior surface. A single seta is present on the inner margin.

Exopod 3 bears two marginal spines and a row of spinules on that part of the outer margin proximal to the first spine. Five setæ arise from the inner border. The terminal spine is a trifle longer than the last segment, in the proportions 9 : 8.

Endopod 1 is small, and the outer border ends in a short spine. A single seta is present.

Endopod 2 bears an oblique curved row of spinules, usually five or six in number on the posterior surface, and a longitudinal row of four or five needle-like spinules on the outer border, which also terminates in a small spinous process. A corona of small spinules is situated on the anterior aspect near the distal margin. A pair of setæ are present on the inner border.

Endopod 3 bears seven setæ, and a few spinules are present posteriorly.

The Third and Fourth Pairs of Legs are very similar to the second pair, but the terminal spine on the fourth exopodite is shorter than the segment preceding it.

The Fifth Pair of Legs.—These, as in all adult males in this genus, are asymmetrical : the left leg consists of a somewhat swollen basal portion and a terminal part composed of four segments. There is an obvious hinge between the basal and terminal portions, and the proportions of the segments are 20 : 15 : 15 : 15 : 12. The last segment ends in two unequal spinous processes, and the penultimate segment bears a single spine at its distal external angle. The right leg is composed of a basal and two free segments. It is much shorter than the left, and ends in two unequal spines.

PARACALANUS PARVUS (Claus.).

Paracalanus parvus, Cleve, 1901, p. 8.
——————— A. Scott, 1902, pp. 402 and 423.
——————— Cleve, 1903, p. 367.
——————— Thompson & Scott, 1903, p. 243.
——————— Cleve, 1904, p. 194.
——————— var. *indicus*, Wolfenden, 1905, p. 998. Pl. XCVI., figs. 7–11 and 16.
——————— A. Scott, 1909, p. 27.
——————— Sewell, 1912, p. 358.

Numerous examples were obtained in the various localities, and its distribution in Indian waters appears to be almost universal. I agree with Scott (*loc. cit.*, 1909) that the minute differences noted by Wolfenden between specimens taken in the North Atlantic Ocean and those from Indian seas are not of sufficient importance to justify the separation of the latter as a special variety.

PARACALANUS SERRATIPES, Sewell.

Paracalanus serratipes, Sewell, 1912, p. 332. Pl. XV figs. 6–10.

This species was first obtained from the Burmese coast ; a few examples occurred in the collections from the pearl banks, which undoubtedly belong to the same species ; they however, differ slightly from the Burmese specimens in that the terminal segment of the first antenna is somewhat longer in proportion to the preceding segments, but in all other respects these examples agree with the type specimens.

Genus **Acrocalanus**, Giesbrecht.

ACROCALANUS LONGICORNIS, Giesbrecht.

Acrocalanus longicornis, Giesbrecht, 1888, p. 332 ; Giesbrecht, 1891, p. 282.
—————— Cleve, 1901, p. 5.
—————— Thompson & Scott, 1903, p. 243.
—————— Wolfenden, 1905, p. 1000.
—————— Scott, 1909, p. 28.
—————— Sewell, 1912, p. 358.
—————— Pesta, 1913, p. 13, fig. 14.

Examples of this species were fairly plentiful ; it appears to have a wide distribution in Indian seas.

ACROCALANUS GRACILIS, Giesbrecht.

Acrocalanus gracilis, Giesbrecht, 1896, p. 318.
—————— Cleve, 1901, p. 4.
—————— Thompson & Scott, 1903, p. 243.
—————— Cleve, 1903, p. 356.
—————— Cleve, 1904, p. 184.
—————— Wolfenden, 1905, p. 1003.
—————— Scott, 1909, p. 29.
—————— Sewell, 1912, p. 359.

This species was by no means common in the collections all the examples obtained were females.

ACROCALANUS MONACHUS, Giesbrecht.

Acrocalanus monachus, Thompson & Scott, 1903, p. 243.
——— Cleve, 1903, p. 356.
——— Wolfenden, 1905, p. 1002.
——— A. Scott, 1909, p. 30.
——— Sewell, 1912, p. 359.

A few specimens were obtained.

ACROCALANUS GIBBER, Giesbrecht.

Acrocalanus gibber, Giesbrecht, 1888, p. 332.
——— Giesbrecht, 1891, p. 282.
——— Giesbrecht, 1896, p. 318.
——— Thompson, 1899, p. 276.
——— Cleve, 1901, pp. 4 and 36. Pl. II., figs. 1–16.
Acrocalanus pediger (♀ part), Cleve, 1901, pp. 5 and 33. Pl. I., figs. 1–14.
Acrocalanus gibber, A. Scott, 1902, pp. 402 and 423.
Acrocalanus gibber, Thompson & Scott, 1903, p. 243.
Acrocalanus pediger, Cleve, 1903, p. 356.
Acrocalanus gibber, Cleve, 1904, p. 184.
——— Wolfenden, 1905, p. 1003.
——— A. Scott, 1909, p. 29.
——— Sewell, 1912, pp. 315 and 359.

Considerable confusion appears to have arisen with regard to this species. The original description was based on female examples only, and this form is easily recognized by the shape of the body and the partial separation of the first thoracic segment from the head region. Cleve (*loc. cit.*, 1901) described a form from the Malay Archipelago which he considered to be the adult male ; these examples, though closely resembling the female as regards the armature of the swimming legs, yet differ considerably in the shape and structure of the cephalothorax. In the same paper he described a form which he named *A. pediger*, but as I have already pointed out (*vide* *ante*, pp. 205, 206), the male of this so-called *Acrocalanus* is in reality the male *Paracalanus aculeatus*. The supposed female is undoubtedly an *Acrocalanus*, but is an immature male : the presence of a fifth leg on the left side and the segmentation of the abdomen are sufficient to indicate the sex, and the form apparently corresponds to the male *Acrocalanus gibber*. In the Ceylon collections numerous examples of this immature male were present, and in almost every case were associated with both immature and mature females of the above species.

ACROCALANUS GARDINERI, Wolfenden.

Acrocalanus gardineri, Wolfenden, 1905, p. 1004. Pl. XCVII., figs. 5, 10, 14–21.
——————— Sewell, 1912, p. 359.

The above name was given by Wolfenden to certain adult males that he found in Professor Stanley Gardiner's collections from the Maldive and Laccadive Archipelagoes. In the present collections are several examples that agree very fairly well with Wolfenden's description and figures. These males are usually associated with females that appear to belong to the species *A. gracilis*, and I am inclined to regard *A. gardineri* and *A. gracilis* as synonymous, but, at the present time, the data at my disposal is not sufficient to warrant a definite pronouncement on this point.

ACROCALANUS SIMILIS, sp. nov.

(Pl. XVII., figs. 3–5.)

Several examples, both male and female, of a species of *Acrocalanus* were obtained at several stations in the Gulf of Mannar. At first sight I took these specimens to be examples of *A. inermis*, a species that was described by me (*loc. cit.*, 1912, p. 334, Pl. XVI., figs. 1–9) from the coast of Burma, but a closer examination revealed the fact that, although the resemblance between these two forms is very close, yet they differ in several characters, and I consider that the present examples are in all probability a new species, for which I propose the above name.

♀. Total length, 0·75–0·80 mm.

The proportions of cephalothorax and abdomen are as 3 : The head and first thoracic segment are fused together, as also in adult specimens are thoracic segments 4 and 5, though in immature forms the line of separation between the latter can readily be made out. The posterior thoracic margin is rounded and is devoid of spines. The rostrum is bifid, and is long and slender.

The abdomen consists of four segments, having with the furcal rami the following proportions : 17 : 10 : 10 : 15 : 13. The first segment shows a prominent genital swelling on the ventral aspect.

The first antenna when folded back reaches to the end of the furcal rami, the first and second segments are fused, and the line of separation between segments 8 and 9 is not complete, being only present on the posterior aspect.

The antennal joints have the following proportions :—

Segments :	1–2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
	120	32	32	36	36	29	26	28	28	29	34	38

Segments :	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
	36	36	40	40	44	44	44	48	44	52	44	60

The mouth parts closely resemble those of *A. inermis*, but the mandible is slightly different : the arrangement of the teeth is the same, but the separate first tooth has a longer and somewhat narrower basal portion. The swimming legs in these two species are very similar : in both cases the external margin of the exopodites is devoid of any spines, but in the present form there are no spines on the posterior aspect of exopod 2 in the second to fourth pairs.

♂. Total length, 0·8 mm.

The proportional lengths of cephalothorax and abdomen are 2·25 : 1. The abdomen consists of five segments, having with the furcal rami the proportional lengths 10 : 20 : 15 : 15 : 13 : 12.

First Antenna.—As in other members of this genus, the basal segments are fused together to form two large joints. The proportional lengths of the various joints are as follows :—

Segments :	1–6.	7–8.	9.	10.	11.	12.	13.	14.	15.	16.
	286	73	24	25	29	29	36	34	39	39

Segments :	17.	18.	19.	20.	21.	22.	23.	24.	25.
	39	41	44	44	48	48	48	44	29

Second Antenna.—As in other members of the genus, in adult males the last joint of the exopodite is devoid of setæ, and forms a nipple-like projection.

The first to fourth pairs of swimming feet are the same as in the female ; the fifth leg on the left side is present, and consists of a somewhat swollen basal segment and four free joints : the terminal joint bears two unequal setæ, and the penultimate joint has a short spine at its distal external angle.

It is obvious that this species is very closely related to *A. inermis,* from the Burma coast, but it differs from it in the following characters :—

(1) The total length is somewhat smaller.
(2) The terminal segment of the first antenna in the female is somewhat longer, and there are no transverse rows of spinules on segments 1–6.
(3) There are no spinules on the posterior thoracic margin.
(4) There are no spines on the posterior aspect of exopod 2 of any of the swimming legs.
(5) The rostrum is long and slender.

It is possible that these differences may be merely due to altered environment, but for the present I prefer to consider the above a new species, and I have therefore given it the name *A. similis.*

Genus **Calccalanus,** Giesbrecht.

CALOCALANUS PAVO (Dana).

Calocalanus pavo, Giesbrecht, 1896, p. 317.
———————— Thompson, 1899, p. 277.
———————— Cleve, 1901, p. 5.

Calocalanus pavo, Scott, 1902, pp. 402 and 423.
———— Thompson & Scott, 1903, p. 243.
———— Cleve, 1903, p. 357.
———— Cleve, 1904, p. 186.
———— Wolfenden, 1905, p. 999.
———— Scott, 1909, p. 30.
———— Sewell, 1912, p. 359.

This species is widely distributed throughout Indian waters. Several examples were obtained on the pearl banks.

CALOCALANUS PLUMULOSUS (Claus.).

Calocalanus plumulosus, A. Scott, 1902, pp. 403 and 423.
———— Thompson & Scott, 1903, p. 243.
———— Wolfenden, 1905, p. 999.
———— A. Scott, 1909, p. 31.
———— Sewell, 1912, p. 360.

A few examples were obtained from Dutch Moderagam Paar.

Family PSEUDOCALANIDÆ.

Genus **Clausocalanus**, Giesbrecht.

CLAUSOCALANUS ARCUICORNIS (Dana).

Clausocalanus arcuicornis, Thompson, 1899, p. 277.
———— Cleve, 1901, p. 5.
———— Thompson & Scott, 1903, p. 243.
———— Cleve, 1903, p. 359.
———— Cleve, 1904, p. 188.
———— Wolfenden, 1905, p. 999.
———— A. Scott, 1909, p. 32.
———— Sewell, 1912, p. 360.

Several examples were obtained on the pearl banks.

CLAUSOCALANUS FURCATUS (Brady).

Clausocalanus furcatus, Giesbrecht, 1896, p. 317.
——————— Cleve, 1901, p. 5.
——————— A. Scott, 1902, pp. 403, 423.
——————— Thompson & Scott, 1903, p. 244.
——————— Cleve, 1903, p. 360.
——————— Cleve, 1904, p. 188.
——————— Wolfenden, 1905, p. 999.
——————— A. Scott, 1909, p. 32.

Examples of this species were comparatively common; both it and the preceding species appear to have a wide distribution in Indian waters.

Genus **Euchæta,** Philippi.

EUCHÆTA MARINA (Prestandrea).

Euchæta marina, Thompson, 1899, p. 278.
——————— Cleve, 1901, p. 7.
——————— A. Scott, 1902, p. 403.
——————— Thompson & Scott, 1903, p. 244.
——————— Cleve, 1903, p. 363.
——————— Cleve, 1904, p. 190.
——————— Wolfenden, 1905, p. 1007. Pl. C., figs. 19 and 20 (♂).
Euchœta indica, Wolfenden, 1905, p. 1008. Pl. C., figs. 12–16 (♀).
Euchæta marina, A. Scott, 1909, p. 67. Pl. XIX., figs. 9–20.
——————— Sewell, 1912, p. 360.
——————— Pesta, 1912, p. 45.
——————— Pesta, 1913, p. 32.

Several examples of this species, belonging to both sexes, were obtained on the pearl banks.

EUCHÆTA CONCINNA, Dana.

Euchæta concinna, Cleve, 1901, p. 7.
—————— Thompson & Scott, 1903, p. 244.
—————— Cleve, 1903, p. 363.
—————— Wolfenden, 1905, p. 1008. Pl. C., figs. 1–6.
—————— A. Scott, 1909, p. 65. Pl. XIX., figs. 21–27.
—————— Sewell, 1912, p. 360.

This species was by far the most common example of the genus present in the Ceylon collection.

EUCHÆTA WOLFENDENI, Scott.

Euchæta marina, Wolfenden, 1905, p. 1007. Pl. C., figs. 7, 8, 10, 11, 17, 18.
Euchæta wolfendeni, A. Scott, 1909, p. 68. Pl. XVII., figs. 1–12.

Two examples of this species were obtained from Karativu Paar and Dutch Moderagam Paar, respectively.

This species apparently has a wide distribution in Indian waters, for I have recently obtained specimens from tow-nettings taken off the Andaman Islands, and from the Ganjam coast.

Family SCOLECITHRICIDÆ.

Genus **Scolecithrix**, G. Brady.

SCOLECITHRIX DANÆ (Lubbock).

Scolecithrix danæ, Thompson, 1899, p. 279.
—————— Cleve, 1901, p. 9.
—————— A. Scott, 1902, p. 403.
—————— Thompson & Scott, 1903, p. 245.
—————— Cleve, 1903, p. 368.
—————— Cleve, 1904, p. 197.

Scolecithrix danæ, Wolfenden, 1905, p. 1009.
—————— A. Scott, 1909, p. 88.
—————— Sewell, 1912, p. 360.

This species was comparatively rare in the collection.

Genus **Scolecithricella,** Sars.

SCOLECITHRICELLA PEARSONI, sp. nov.

(Pl. XVII., figs. 6, 7, and Pl. XVIII., figs. 1–4).

A single male and several females of a species of *Scolecithricella* were obtained at Dutch Moderagam and Karativu Paars. The examples appear to belong to a hitherto undescribed species, and I have given it the above name after Dr. J. Pearson, the Director of the Colombo Museum, who kindly entrusted the present collection from the Ceylon pearl banks to my care for the purpose of examination.

The characters of the above species are as follows :—

♀. Total length, 1·0 mm.

The proportions of cephalothorax and abdomen are 3·5 : 1. The cephalothorax is robust, and is uniformly rounded dorsally. The head and first thoracic segment are fused together, as also are thoracic segments 4 and 5. The rostrum consists of two stout spinous processes. The abdomen has four segments, showing with the furcal rami the following relative proportional lengths :—6 : 3 : 3 : 1 : 2.

The first antenna is short and reaches, when folded back, to the posterior end of the thorax : it consists of twenty joints having the following proportional lengths :—

Segments :	1–2.	3.	4.	5.	6.	7.	8–10.	11.	12–13.	14.
	102	27	23	23	23	23	58	23	51	39
Segments :	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**	**21.**	**22.**	**23.**	**24–25.**
	43	47	47	51	51	51	58	66	89	105

The first and second, eighth to tenth, and twelfth and thirteenth segments are respectively fused together, and so are the twenty-fourth and twenty-fifth.

The second antenna and mouth parts are similar to those of other members of the genus.

The First Pair of Legs.—The first basal joint bears no external spine or internal seta; the external margin bears a series of fine curved spinules, diminishing in size proximally; the second basal joint bears no marginal spine, but carries a single seta on its inner distal angle.

The exopodite consists of three segments: exopod 1 bears no marginal spine; exopod 2 has a single spine, as usual; exopod 3 in most cases bears a single spine on the external margin at its distal extremity, but in two of the specimens examined (a ♂ and a ♀) there was a second spine present at the junction of the middle and distal thirds. The end spine is long and slender, and is equal in length to the preceding two segments. The endopodite consists of a single segment having a well-marked rounded swelling on the external border, and across the base of this swelling is a transverse row of needle-like spines.

The Second Pair of Legs.—The first basal bears a single seta internally, and is finely serrated on the proximal two-thirds of the outer margin. The second basal is produced at both the internal and external distal angles in a triangular spinous process.

The exopodite consists of three segments: exopod 1 bears a single seta internally, and externally is armed with a long spine that reaches as far as the base of the spine on the succeeding segment; exopod 2 bears a single internal seta, and the external spine extends well beyond the base of the proximal spine on exopod 3. On the posterior aspect are two rows of small spinules, one row extends vertically down the centre of the segment and the second runs horizontally along the distal margin; exopod 3 bears four setæ on its internal margin, and externally is armed with three teeth of more or less equal size. On its posterior aspect, this segment carries three curved rows of spinules. Terminally, the end spine is broad and somewhat curved, having a finely-serrated outer margin.

The endopodite is two-jointed: endopod 1 bears a single inner seta, and externally is produced at its distal extremity in a sharp spinous projection; exopod 2 bears five setæ and terminates in a small apical spinous process, while on its posterior aspect it carries a series of sharp needle-like spines.

The Third Pair of Legs.—Basal 1 bears a single internal seta, and is finely serrated on its external margin ; basal 2 has a spine-like projection on both inner and outer ends of the distal margin. Both exopodite and endopodite consist of three segments : exopod 1 has a single external spine and one internal seta ; exopod 2 is similarly provided ; exopod 3 bears three external spines ; all the marginal spines are of equal size. In addition, certain of these segments are armed with rows of spinules ; the second basal segment carries a series of small spines on the triangular projection of its distal margin, behind the base of exopod 1 ; exopod 2 bears a transverse row of spines parallel to its posterior distal margin, and exopod 3 bears two rows of spines, one distally along the transverse border and one shaped like ɿ about the middle of its length, both on the posterior aspect.

Endopod 1 bears a single internal seta, and terminates externally in a sharp spine-like process ; exopod 2 is similarly provided, and in addition is armed with long needle-like spines on its posterior aspect. Endopod 3 bears five setæ, and is armed with spines like the preceding segment.

The fourth pair of legs are similar to the third pair, but are armed with a transverse row of spines of the first basal segment, and the marginal serration on this segment is absent.

The fifth pair of legs have the form characteristic of the genus. The single segment bears three spines ; the outer is extremely small and arises from the external margin ; the second arises distally and is somewhat longer ; the third spine is large and projects inwards from the inner margin ; it is finely serrated on its internal border.

♂. The total length, 7·0 mm.

The proportional lengths of cephalothorax and abdomen are 3 : 1. The abdomen consists of four segments having, with the furcal rami, the following proportions : 15 : 25 : 20 : 22 : 10.

The first antenna consists of eighteen joints, having the following relative lengths :—

Segments :	1.	2.	3.	4.	5.	6.	7.	8–14.	15.
	54	32	29	25	25	25	25	132	32

Segments :	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
	50	64	68	68	71	75	43	86	96

The eighth to the fourteenth segments inclusive appear to have fused to form a single joint.

The second antenna, mouth-parts, and swimming legs are the same as those of the female.

The Fifth Pair of Legs.—Each leg has a stout basal segment and a short one-jointed endopodite ; the right exopodite consists of three segments ; exopod 2 bears a row of small spines on the distal part of its inner margin ; exopod 3 is somewhat claw-shaped, terminating in a sharp point and having a swollen base. The proportional lengths of the basal joint and exopods are 24 : 22 : 16 : 8 ; the relative length of the endopod is 8.

The left leg has the basal joint produced in a somewhat swollen rounded projection distally. The exopod is two-jointed, each joint being of nearly equal length ; the terminal joint is tapered, ending in a sharp point. The endopod is short and spine-like.

Tribe **HETERARTHANDRIA.**

Family CENTROPAGIDÆ.

Genus **Centropages,** Kroyer.

CENTROPAGES FURCATUS (Dana).

Centropages furcatus, Giesbrecht, 1889, Sem. 1, p. 811.
———————— Giesbrecht, 1891, p. 282.
———————— Giesbrecht, 1893.
———————— Giesbrecht, 1896, p. 317.
———————— Thompson, 1899, p. 279.
———————— Cleve, 1901, p. 5.
———————— A. Scott, 1902, pp. 403 and 423.

Centragages furcatus, Cleve, 1903, p. 359.
———————— Thompson & Scott, 1903, p. 246.
———————— Cleve, 1904, p. 187.
———————— Wolfenden, 1905, p. 1016.
———————— A. Scott, 1909, p. 113.
———————— Pesta, 1912, p. 46, fig. 5.
———————— Sewell, 1912, pp. 315 and 360.
———————— Pesta, 1913, p. 32.

This species is widely distributed throughout Indian waters, and numerous examples were obtained from the pearl banks.

CENTROPAGES ORSINII, Giesbrecht.

Centropages orsinii, Giesbrecht, 1889, Sem. 1, p. 811.
———————— Giesbrecht, 1891, p. 282.
———————— Giesbrecht, 1893.
———————— Giesbrecht, 1896, p. 317.
———————— Cleve, 1901, p. 5.
———————— A. Scott, 1902, pp. 404 and 423.
———————— Cleve, 1903, p. 359.
———————— Thompson & Scott, 1903, p. 247.
———————— Wolfenden, 1905, p. 1015. Pl. XCVIII., figs. 1, 4, 8, 11, 12 ♂, and 5, 13 ♀.
———————— A. Scott, 1909, p. 115.
———————— Pesta, 1912, p. 46, fig. 6.
———————— Sewell, 1912, pp. 315 and 362.
———————— Pesta, 1913, p. 32.

Examples of this species were of common occurrence, and were widely distributed throughout the areas under investigation.

CENTROPAGES TENUIREMIS, Thompson & Scott.

Centropages tenuiremis, Thompson & Scott, 1903, p. 247. Pl. I., figs. 14–18.
Centropages arabicus, Cleve, 1903, p. 371. Pl. XVI., figs. 1–9, and Pl. XVII., fig. 1.

Centropages tenuiremis, Sewell, 1912, p. 363. Pl. XXIV., figs. 6–7.

This species has now been reported from the Arabian Sea, the coastal waters of Ceylon, and the coast of Burma. It was present in several of the tow-nettings from the pearl banks, but never in any considerable numbers.

CENTROPAGES DORSISPINATUS, Thompson & Scott.

Centropages dorsispinatus, Thompson & Scott, 1903, p. 247. Pl. I., figs. 19–25.
Centropages notoceras, Cleve, 1903, pp. 359 and 373. Pl. XVII., figs. 2–10, and Pl. XVIII., fig. 1.
——————— Sewell, 1912, p. 360.

Several examples of this species were taken in a tow-netting at Kilakarai at the head of the Gulf of Mannar. As I have already pointed out (*loc. cit.*), the descriptions given by Thompson & Scott and Cleve differ in several details ; the present specimens agree exactly with those from the Persian Gulf and from Burma.

CENTROPAGES ELONGATUS, Giesbrecht.

Centropages elongatus, Giesbrecht, 1896, pp. 317, 322. Pl. V., figs. 3–6.
——————— A. Scott, 1902, p. 404. Pl. I., figs. 13, 14.
——————— Cleve, 1903, p. 359.
——————— Thompson & Scott, 1903, p. 246.
——————— Wolfenden, 1905, p. 1014. Pl. XCVIII., figs. 2, 3, 9, 10, 14.
——————— A. Scott, 1909, p. 113.

This species is comparatively rare in the present collections. A few examples of both sexes were obtained at Dutch Moderagam, Krusadai, and Jokenpiddi Paars.

CENTROPAGES GRACILIS (Dana).

Centropages gracilis, Cleve, 1901, p. 5.
——————— Cleve, 1903, p. 359.
——————— Thompson & Scott, 1903, p. 247.
——————— Wolfenden, 1905, p. 1013. Pl. XCVIII., fig. 7.
——————— A. Scott, 1909, p. 114.

A single example of a mature female was obtained at Jokenpiddi Paar.

CENTROPAGES TRISPINOSUS, sp. nov.

(Pl. XVIII., figs. 5–8.)

A single example, a female, of apparently a new species of *Centropages*, was taken in a tow-netting at Kilakarai. The single specimen obtained presents several characteristic features in which it differs from all previously described specimens, and I have therefore given it the above name.

♀ Total length, 1·4 mm.

The proportional lengths of cephalothorax and abdomen are 3 : 1. The head and first thoracic segment are quite separate, as also are thoracic segments four and five. The dorsum is uniformly rounded. The posterior thoracic margin is rounded, and is armed with three short spines situated rather towards the ventral side. The rostrum consists of two slender processes. The abdomen possesses three segments having, with the furcal rami, the proportional lengths 4 : 3 : 2 : 2. The genital segment is somewhat barrel-shaped, and has a rounded swelling on the dorsal apect.

The first antenna, when folded back, reaches to the end of the abdomen. The number and relative lengths of the basal segments are not easily determined; apparently several segments are fused together to form the second joint, and the eighth and ninth are also partially fused, and the twenty-fourth and twenty-fifth segments completely so.

The proportional lengths of the various joints are as follows :—

Segments :	1.	2–4.	5.	6.	7.	8–9.	10.	11.	12.	13:
	43	43	14	17	28	37	23	26	37	63

Segments :	14:	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
	68	68	77	86	88	77	51	46	31	34	43

The Fifth Pair of Legs.—Both rami are three-jointed.

Exopod 1 bears a marginal spine, but has no internal seta ; exopod 2, in addition to the single external marginal spine, bears the usual spine on its inner border. This spine is long and has a somewhat swollen base ; it tapers gradually to a fine point and bears no teeth on its surface. Exopod 3 has two marginal spines and a finely serrated end-spine.

The endopodite reaches to the level of the joint between exopods 2 and 3. Endopod 1 presents a well-marked rounded swelling at its distal external angle.

The remaining appendages appear to be very similar to those of *Centropages alcocki* (Sewell, 1912, p. 338, Pl. XVII., figs. 1–7), but the serrations on the terminal spines of the swimming feet are not so coarse and are less widely separated.

Genus **Pseudodiaptomus,** Herrick.

PSEUDODIAPTOMUS AURIVILLII, Cleve.

Pseudodiaptomus aurivillii, Cleve, 1901, p. 48. Pl. VI., figs. 11–22, and Pl. VII., figs. 1, 2.
——————— Thompson & Scott, 1903, p. 248. Pl. II., figs. 24–26.
——————— A. Scott, 1909, p. 116.
——————— Sewell, 1912, p. 363.

Numerous examples of both sexes were obtained in the present collections. The male was first obtained by Thompson and Scott, but as they give no description of its structure I give below a brief account of some of the more salient features.

♂. Total length, 1·1 mm.

Proportional lengths of cephalothorax and abdomen 2 : 1. The head and first thoracic segment are fused completely and thoracic segment 4 and 5 partially so; the postero-lateral border of the fifth segment is, as in the female, armed with a large backwardly projecting spine. The rounded anterior "forehead" terminates ventrally in a bifid rostrum composed of long fleshy processes.

The abdomen consists of five segments having, with the furca, the following relative proportions:—16 : 25 : 24 : 24 : 11 : 21. Segments 2 to 4 inclusive are armed round their posterior borders with a series of triangular spines.

The first antenna on the right side is modified to form a grasping organ; it is composed of twenty joints, having the following relative proportional lengths:—

Segments:	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	95	52	24	14	14	19	14	14	24	28
Segments:	11.	12.	13.	14.	15.	16.	17.	18.	19–20.	21–23.
	24	24	28	66	57	62	43	118	114	165

The knee-joint is situated between segments 18 and 19, and the "Endabschnitt" consists of two joints only, segments 19 and 20 and 21 to 23 being respectively fused together. Segment 10 bears a long spine-like seta, and segments 12 to 16 are all armed with needle-like spines; the seventeenth segment bears a lamellar process on its anterior aspect; both segments of the knee-joint are armed with lamellar plates, that on the proximal segment being armed with needle-like teeth, while that on the distal is unarmed.

The Second Antenna.—The two rami are of nearly equal length; the last joint of the exopodite is swollen and nipple-shaped. The endopodite is of the usual type.

The Second Maxilliped.—Basal 1 is three-fifths as long as broad; it bears four setæ on its anterior border and carries a single stout spine-like seta distally; basal 2 is beset with fine hairs proximally, and about the middle of its length bears three stout setæ; it is about twice as long as broad. The terminal portion of the appendage consists of the usual five segments.

The First Pair of Swimming Legs.—Basal 1 bears an internal seta, and is armed with a few spines on its anterior aspect near the base ; basal 2 bears a corona of spines distally on its outer and anterior surfaces. The rami are in exact agreement with Cleve's original description (*loc. cit.*, 1901).

The remaining swimming legs are similar to those of the female, and the fifth pair of legs correspond exactly with the description given by Thompson and Scott.

PSEUDODIAPTOMUS SERRICAUDATUS (T. Scott).

Pseudodiaptomus serricaudatus, A. Scott, 1902, p. 404. Pl. I., fig. 6.
———————— Cleve, 1903, p. 368.
———————— Thompson & Scott, 1903, p. 248.
———————— Cleve, 1904, p. 196.
———————— Tollinger, 1911, p. 177.

Examples of this species were of common occurrence throughout the area under investigation.

Family TEMORIDÆ.

Genus **Temora,** W. Baird.

TEMORA DISCAUDATA, Giesbrecht.

Temora discaudata, Giesbrecht, 1889, Sem. 1, p. 814.
———————— Giesbrecht, 1891, p. 282.
———————— Giesbrecht, 1896, p. 317.
———————— Thompson, 1899, p. 280.
———————— Cleve, 1901, p. 9.
———————— A. Scott, 1902, pp. 405 and 423.
———————— Cleve, 1903, p. 369.
———————— Thompson & Scott, 1903, p. 248.
———————— Cleve, 1904, p. 198.
———————— Wolfenden, 1905, p. 1023.

Temora discaudata, A. Scott, 1909, p. 118.
———————— Pesta, 1912, p. 47, fig. 7.
———————— Sewell, 1912, p. 365. Pl. XXII., figs. 8, 9.

Numerous examples of this species were obtained; as the above list of references shows, it is widely distributed throughout Indian waters.

TEMORA STYLIFERA (Dana).

Temora stylifera, Thompson, 1899, p. 280.
———————— Cleve, 1901, p. 9.
———————— A. Scott, 1902, p. 404.
———————— Cleve, 1903, p. 369.
———————— Thompson & Scott, 1903, p. 249.
———————— Cleve, 1904, p. 198.
———————— Wolfenden, 1905, p. 1023.
———————— Sewell, 1912, p. 366.

The above species also appears to be widely distributed throughout Indian waters; it was common in the present collections.

TEMORA TURBINATA (Dana).

Temora turbinata, Giesbrecht, 1889, Sem. 1, p. 814.
———————— Giesbrecht, 1891, p. 282.
———————— Giesbrecht, 1896, p. 318.
———————— Thompson & Scott, 1903, p. 249.
———————— Scott, 1909, p. 118.
———————— Pesta, 1912, p. 48, fig. 8.
———————— Sewell, 1912, p. 366.
———————— Pesta, 1913, p. 32.

This species also was common in the collections, and appears to be widely distributed in these waters.

Family LUCICUTIIDÆ.

Genus **Lucicutia,** Giesbrecht.

LUCICUTIA FLAVICORNIS (Claus.).

Leuckartia flavicornis, Cleve, 1901, p. 7.
Lucicutia flavicornis, A. Scott, 1902, p. 405.
———————— Thompson & Scott, 1903, p. 249.
———————— Cleve, 1903, p. 364.
———————— Cleve, 1904, p. 192.
———————— Wolfenden, 1905, p. 1012.
———————— A Scott, 1909, p. 125.
———————— Sewell, 1912, p. 366.

A few examples only were obtained.

Genus **Metacalanus,** Cleve.

METACALANUS AURIVILLII, Cleve.

Metacalanus aurivillii, Cleve, 1901, pp. 7, 43. Pl. IV., figs. 16–25, and Pl. V., figs. 1–6.
———————— Thompson & Scott, 1903, p. 243. Pl. II., figs. 18–20.
———————— A. Scott, 1909, p. 146.

Numerous examples of this species were obtained. It has now been reported from the Malay Archipelago and Ceylon, and I have myself found it in the Plankton of the Tenasserim coast. It was also of frequent occurrence in the " Siboga " collection, and is probably widely distributed throughout the Indian seas. Owing to its small size, however, it is very liable to be overlooked.

Family CANDACIIDÆ.

Genus **Candacia,** Dana.

CANDACIA ÆTHIOPICA (Dana).

Candacia æthiopica, Thompson, 1899, p. 281.
———————— Scott, 1902, p. 405.

Candacia æthiopica, Thompson & Scott, 1903, p. 250.
———————— Cleve, 1903, p. 358.
———————— Scott, 1909, p. 151.
———————— Sewell, 1912, p. 366.

Only a few examples were obtained in the present collections.

CANDACIA CATULA (Giesbrecht).

Candacia catula, Giesbrecht, 1896, p. 317.
———————— Cleve, 1901, p. 5.
———————— Scott, 1902, p. 405.
———————— Thompson & Scott, 1903, p. 250.
———————— Cleve, 1903, p. 358.
———————— Cleve, 1904, p. 186.
———————— Wolfenden, 1905, p. 1012.
———————— Scott, 1909, p. 152.
———————— Sewell, 1912, p. 367.

This species appears to be widely distributed throughout Indian waters. It was by no means common on the pearl banks, but several examples of both sexes were obtained.

CANDACIA BRADYI, A. Scott.

Candacia bradyi, Scott, 1902, p. 406. Pl. I., figs. 9–12 (♂).
———————— Thompson & Scott, 1903, p. 250.
Candacia tuberculata, Wolfenden, 1905, p. 1013.
Candacia bradyi (♂ part), Carl, 1907, p. 9. Pl. I., figs. 11 and 14, and Pl. XCVI., figs. 40–44 (♂).
———————— Scott, 1909, p. 156. Pl. XLVII., figs. 1–9 (♂).
———————— Pesta, 1912, p. 49, fig. 9 (♀).
———————— Sewell, 1912, p. 366. Pl. XXIII., figs. 6 and 7 ( ).

This species appears to have a fairly wide distribution throughout Indian waters. Its occurrence has now been reported from localities ranging from the Persian Gulf to Amboina and the Phillippines.

CANDACIA DISCAUDATA, Scott.

Candacia bradyi (♀ part), Carl, 1907, p. 9. Pl. I., figs. 8–10, 12–13.
Candacia discaudata, Scott, 1909, p. 157. Pl. XLVII., figs. 10–20.
—————— Sewell, 1912, p. 367.

The first to describe this species was Dr. J. Carl; he, however, only had the female sex before him, and he made the mistake of associating his examples with *Candacia bradyi*, Scott, of which at that time only the male was known. Scott, who does not appear to have been acquainted with Carl's Paper, re-described the species from the Siboga collection under the above name.

Several examples of both sexes were obtained from the pearl banks, so the known distribution of this form is extended considerably to the westward.

CANDACIA PACHYDACTYLA, Dana.

Candace pachydactyla, Cleve, 1901, p. 5.
Candacia pachydactyla, Thompson & Scott, 1903, p. 251.
—————— Cleve, 1903, p. 358.
—————— Cleve, 1904, p. 187.
—————— Wolfenden, 1905, p. 1013.
—————— Scott, 1909, p. 153.
—————— Sewell, 1912, p. 368.

Although this species appears to be widely distributed throughout Indian waters, it was of rare occurrence in the present collection.

CANDACIA TRUNCATA, Dana.

Candacia truncata, Thompson, 1899, p. 282.
—————— Scott, 1902, p. 405.
—————— Thompson & Scott, 1903, p. 250.
—————— Cleve, 1903, p. 358.

Candacia truncata, Cleve, 1904, p. 187.
—————— Wolfenden, 1905, p. 1013.
—————— Scott, 1909, p. 155.
—————— Sewell, 1912, p. 368.

This species also appears to have a wide distribution, but only a single specimen was found in the collection.

Family PONTELLIDÆ.

Genus **Calanopia,** Dana.

CALANOPIA ELLIPTICA (Dana).

Calanopia elliptica, Giesbrecht, 1896, pp. 317, 325. Pl. V., figs. 7–9.
—————— Thompson, 1899, p. 282.
—————— Cleve, 1901, p. 5.
—————— A. Scott, 1902, pp. 406 and 423.
—————— Thompson & Scott, 1903, p. 251.
—————— Cleve, 1903, p. 356.
—————— Wolfenden, 1905, p. 1023.
—————— A. Scott, 1909, p. 177. Pl. XLVIII., figs. 1–5.
—————— Pesta, 1912, p. 50, fig. 10.
Calanopia sp. (= ♂ juv.), Pesta, 1912, p. 52, fig. 12.
Calanopia elliptica, Sewell, 1912, p. 368.
—————— Pesta, 1913, p. 32.

This species is of comparatively common occurrence in Indian waters ; examples of both sexes were plentiful in the Ceylon collection. The form described by Dr. Pesta (*loc. cit.*, 1912) is, in my opinion, a young and immature male ; the form of the fifth appendage is exactly similar to that found in young males just before they undergo the sexual moult.

CALANOPIA AURIVILLII, Cleve.

Calanopia aurivillii, Cleve, 1901, p. 37. Pl. II., figs. 17–23, and Pl. III., figs. 1–10.
—————— Thompson & Scott, 1903, p. 251.

Calanopia minor, Sewell, 1912, p. 368.
Calanopia aurivillii, A. Scott, 1909, p. 181. Pl. XLVIII., figs. 16–20.

Numerous examples of both sexes were obtained in the Ceylon collections ; they agree exactly with the descriptions of Cleve and Scott. I have re-examined the specimens which I recorded from the coast of Burma under the name *C. minor* and I find that for the most part they do not belong to that species, but are examples of *C. aurivillii*.

Calanopia thompsoni, A. Scott.

Calanopia thompsoni, Scott, 1909, p. 17*a*. Pl. XLIX. figs. 1–8.
———————— Sewell, 1912, p. 368.

Numerous examples of this species were obtained from the Ceylon pearl banks ; they were especially common in a tow-netting from Marichchukkaddi Bay. Its occurrence in these waters increases the range of this species very considerably.

Calanopia minor, A. Scott.

Calanopia minor, A. Scott, 1902, p. 406. Pl. I., figs. 1–5.
———————— Thompson & Scott, 1903, p. 251.
———————— Cleve, 1903, p. 356.
———————— Wolfenden, 1905, p. 1023.
———————— A. Scott, 1909, p. 177. Pl. XLVIII., figs. 6–10.
———————— Pesta, 1912, p. 51.
———————— Sewell, 1912, p. 368.

A few examples of this species were obtained on the pear banks, but on the whole it was comparatively rare.

Genus **Labidocera.**

Labidocera acuta (Dana).

Labidocera acutum, Giesbrecht, 1889, p. 27.
———————— Giesbrecht, 1891, p. 282.

Labidocera acuta, Giesbrecht, 1896, p. 317.
——————— Thompson, 1899, p. 282.
——————— Cleve, 1901, p. 7.
——————— A. Scott, 1902, p. 407.
——————— Thompson & Scott, 1903, p. 251.
——————— Cleve, 1903, p. 363.
——————— Cleve, 1904, p. 191.
——————— Wolfenden, 1905, p. 1016.
——————— Scott, 1909, p. 164.
——————— Pesta, 1912, p. 52, fig. 13.
——————— Sewell, 1912, p. 368.
——————— Pesta, 1913, p. 32.

This species was of common occurrence in the Ceylon collections. As the above list of references indicates, it has a wide distribution throughout Indian waters.

LABIDOCERA KROYERI (Brady).

Labidocera kroyeri, Cleve, 1901, p. 7.
——————— Thompson & Scott, 1903, p. 251.
——————— Scott, 1909, p. 165.
——————— Sewell, 1912, p. 369.
Labidocera kroyeri var. *stylifera,* Thompson & Scott.
Labidocera kroyeri var. *stylifera,* Thompson & Scott, 1903, p. 252. Pl. II., figs. 8, 9.
——————————— Sewell, 1912, p. 369.
Labidocera kroyeri var. *burmanica,* Sewell.
Labidocera kroyeri var. *burmanica,* Sewell, 1912, p. 369. Pl. XXIII., figs. 4 and 5.

Examples of this species were common throughout the area under investigation. A peculiarity of this species is the degree of variation exhibited by the males. Thompson and Scott described two varieties from the Ceylon coast, var. *stylifera* and var. *gallensis,* and I have previously described a third, var. *burmanica,* from the Tenasserim coast. The vast majority of the males obtained in the present collection belonged to the variety of *stylifera;* a few examples of the *burmanica* variety and two examples of the normal male were also obtained.

LABIDOCERA MINUTA, Giesbrecht.

Labidocera minutum, Giesbrecht, 1889, p. 27.
——————— Giesbrecht, 1891, p. 28*e*.
——————— Cleve, 1901, p. 7.
Labidocera minuta, A. Scott, 1902, p. 407.
——————— Thompson & Scott, 1903, p. 251.
——————— Cleve, 1903, p. 363.
——————— Wolfenden, 1905, p. 1018. Pl. XCVIII., figs. 18, 24, 25, 29, 32, 37
——————— A. Scott, 1909, p. 167.
——————— Pesta, 1912, p. 53, fig. 14.
——————— Sewell, 1912, p. 370.

Examples of this species, though not common, were yet of fairly frequent occurrence in the collections; the species appears to be widely distributed throughout Indian waters.

LABIDOCERA PAVO, Giesbrecht.

(Pl. XXI., figs. 1–3.)

Labidocera pavo, Giesbrecht, 1889, p. 27.
——————— Giesbrecht, 1891, p. 282.
——————— Cleve, 1901, p. 7.
——————— Thompson & Scott, 1903, p. 251.
——————— Cleve, 1903, p. 364.

Numerous examples of this species, including the hitherto unknown male, were obtained in some of the tow-nettings from the pearl banks.

♂. Total length, 2·2 mm.

Proportional lengths of cephalothorax and abdomen about 4 : 1. The head and first thoracic segments are fused together, and there is a well-marked groove across the dorsal aspect of the "neck."

The fourth and fifth thoracic segments are also fused. The posterior thoracic margin is rounded, and is armed with a small spine. The head is furnished with a pair of large eye lenses, and the ventral lens is well developed and of a plum-colour. The rostrum is bifid, and is composed of two slender spines; there is no rostral lens. The abdomen consists of five segments, having, with the furcal rami, the following proportional lengths :—27 : 32 : 32 : 16 : 9 : 38.

The first antenna, when folded back, reaches to the middle of the abdomen; that on the left side consists of twenty-two joints, having the following proportional lengths, and for purposes of comparison I also give the lengths of the joints in the female :—

Segments :	1.	2.	3.	4.	5.	6.	7-8.	9.	10.	11.	12.
♂ ..	65	65	15	11	13	26	49	26	23	38	39
♀ ..	81	81	17	13	14	28	50	22	22	36	38

Segments :	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.
♂ ..	36	41	73	73	81	86	54	52	52	41	41
♀ ..	36	45	66	66	78	81	52	48	50	38	38

Segments 7 and 8 are partially fused together. The right antenna is modified to form a grasping organ; it consists of nineteen joints, having the following proportional lengths :—

Segments :	—	—	—	—	—	—	—	—	12.	13.
♂ ..	56	75	18	14	13	32	37	42	26	24

Segments :	14.	15.	16.	17.	18.	19–21.	22.	23.	24–25.
♂ ..	40	72	87	70	106	119	89	40	40

Segments 11, 12, and 13 each bear a minute spine on the anterior surface; the seventeenth segment bears a curved lamellar plate very similar to that present in *L. detruncata;* the eighteenth segment is armed with a lamellar plate carrying a number of fine acicular spines, and the nineteenth segment carries a raised tooth-plate very similar to that of *L. detruncata*, but only reaching about three-fourths the length of the segment, not beyond the distal joint as in *L. detruncata*, nor is it so rounded at its extremity.

The Fifth Pair of Legs.—That on the right side has much the same shape as that of *L. detruncata*, but the proximal process is not so stout; the left leg also has a similar structure, but the spines on the distal segment are somewhat differently arranged. The first spine arises from the middle of the external margin and the remaining three from the extreme tip ; the inner margin is beset with fine hairs.

It is evident that this species closely resembles *L. detruncata*, but in both sexes there are certain constant differences that render identification comparatively easy.

LABIDOCERA PECTINATA, Thompson & Scott.

Labidocera pectinata, Thompson & Scott, 1903, p. 252. Pl. II., figs. 10–14.

Labidocera similis, Cleve, 1903, pp. 364 and 378. Pl. XIX., figs. 4–6.

Labidocera pectinata, Sewell, 1912, p. 370. Pl. XXIII., figs. 8–9.

A single example of this rare species was obtained from a tow-netting taken at Paumben.

Genus **Pontella**, Dana.

PONTELLA DANÆ, var. CEYLONICA, Thompson & Scott.

Pontella danæ var. *ceylonica*, Thompson & Scott, 1903, p. 252. Pl. II., figs. 1–5.

——————————— Sewell, 1912, p. 370.

A few examples were obtained ; they agree exactly with the original figures and description.

PONTELLA INVESTIGATORIS, Sewell.

Pontella investigatoris, Sewell, 1912, p. 371. Pl. XXIII., figs. 1–3.

This species was first described by me from male examples taken on the coast of Burma. Several specimens were obtained in the present collections from the Ceylon pearl banks, and these agree exactly with the types. One cannot help remarking on the frequency with which these males are associated with the females of the preceding species, and in neither case have any corresponding members of the opposite sex been obtained. The male, *P. danæ*, as described, is obviously not the same as the present species, but it is possible that the variety of the female, as described by Thompson & Scott, is in reality a different species, and I am inclined to regard it as the female of *P. investigatoris*. There is a very close similarity in the general structure, and especially is this seen in the relative lengths of the antennal joints in the two forms. I give below the proportional lengths of the joints in the antenna of *P. danæ* var. *ceylonica* (♀), and those of the unaltered antenna of *P. investigatoris* (♂).

Segments:	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
P. danæ; var. *ceylonica*. ♀..	95	71	16	17	20	22	20	20	27	23	22	38
P. investigatoris, ♂ ..	98	71	16	16	18	20	18	18	25	20	20	35

Segments ·	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
P. danæ; var. *ceylonica*, ♀..	38	42	47	61	61	66	71	49	47	50	34	43
P. investigatoris, ♂ ..	34	34	44	59	60	70	76	56	56	56	40	48

It is obvious that there is a fairly close resemblance between these two forms, and I am inclined to believe that the form described by Thompson & Scott as *P. danæ* var. *ceylonica* is in reality not a variety of Giesbrecht's species, but the female of *P. investigatoris*.

PONTELLA FERA, Dana.

Pontella fera, Giesbrecht, 1889, p. 28.
——————— Giesbrecht, 1891, p. 282.
——————— A. Scott, 1902, p. 408.
——————— Thompson & Scott, 1903, p. 252.
——————— Wolfenden, 1905, p. 1021.
——————— A. Scott, 1909, p. 159.

Although recorded from various parts of the Indian Ocean and its offshoots, this species would appear to be by no means common; a single example (female) was found in the Ceylon collection.

PONTELLA SECURIFER, Brady.

Pontella securifer, Giesbrecht, 1889, p. 27.
———— Giesbrecht, 1891, p. 282.
———— Thompson & Scott, 1903, p. 252.
———— Cleve, 1904, p. 195.
———— Wolfenden, 1905, p. 1021.
Pontella spinipes (♂), Wolfenden, 1905, p. 1020.
Pontella securifer, A. Scott, 1909, p. 160.
———— Sewell, 1912, p. 372.

A single specimen (♂) was obtained from the pearl banks.

Genus **Pontellopsis,** Brady.

PONTELLOPSIS ARMATA (Giesbrecht).

Monops armatus, Giesbrecht, 1889, p. 28.
———— Giesbrecht, 1891, p. 282.
———— Cleve, 1901, p. 7.
Pontellopsis armata, Thompson & Scott, 1903, p. 253.
———— Wolfenden, 1905, p. 1022. Pl. XCIX., figs. 1–3.
———— A. Scott, 1909, p. 170.

A single example of a male of this species was found in the present collection.

PONTELLOPSIS HERDMANI, Thompson & Scott.

Pontellopsis herdmani, Thompson & Scott, 1903, p. 253. Pl. II., figs. 15–17.
Pontellopsis macronyx, A. Scott, 1909, p. 137. Pl. LIV., figs. 1–10.
Pontellopsis herdmani, Sewell, 1912, p. 375. Pl. XXIV., fig. 5.

Several examples of this species were obtained from the pearl banks. Though differing in several unimportant details from the original description, I have no doubt that the above is the correct specific identity. In the present specimens, the genital segment of the abdomen in the female frequently bears a small spine on the dorsal surface and somewhat towards the left side, in addition to the two on the right side described by Thompson & Scott; in all my specimens the furcal setæ are plumose.

PONTELLOPIS KRAMERI (Giesbrecht).

Monops krameri, Giesbrecht, 1896, pp. 317, 323.
Pontellopsis krameri, A. Scott, 1902, p. 423. Pl. I., figs. 7, 8, and Pl. II., figs. 1, 2.
———————— Thompson & Scott, 1903, p. 253.
———————— Wolfenden, 1905, p. 1021. Pl. XCVIII., figs. 39–41.
———————— A. Scott, 1909, p. 171.
———————— Sewell, 1912, p. 376.

Several examples of the male of this species were obtained, but no corresponding females.

PONTELLOPSIS PERSPICAX (Dana).

Pontellopsis perspicax, Thompson & Scott, 1903, p. 253.
———————— A. Scott, 1909, p. 171.

A single female belonging to the above species was taken at Periya Paar.

PONTELLOPSIS REGALIS (Dana).

Pontellopsis regalis, Thompson, 1899, p. 283.
Monops regalis, Cleve, 1901, p. 7.
Pontellopsis regalis, Thompson & Scott, 1903, p. 253.
Monops regalis, Cleve, 1903, p. 364.
Pontellopsis regalis, A. Scott, 1909, p. 171.
———————— Sewell, 1912, pp. 315, 376.

A single example was obtained in the present collection.

Genus **Pontellina,** Dana.

PONTELLINA PLUMATA (Dana).

Pontellina plumata, Giesbrecht, 1889, p. 29.
——— Giesbrecht, 1891, p. 282.
——— Thompson, 1899, p. 283.
——— Cleve, 1901, p. 8.
——— A. Scott, 1902, p. 408.
——— Thompson & Scott, 1903, p. 253.
——— Cleve, 1903, p. 367.
——— Cleve, 1904, p. 195.
——— Wolfenden, 1905, p. 1022.
——— A. Scott, 1909, p. 175.
——— Sewell, 1912, p. 354.

A few examples of this species were taken in the present collections. Though widely distributed, it does not appear to be common in Indian waters.

Genus **Acartia,** Dana.

ACARTIA CENTRURA, Giesbrecht.

Acartia centrura, Giesbrecht, 1889, p. 25.
——— Giesbrecht, 1891, p. 282.
——— Thompson & Scott, 1903, p. 254.

Several examples were obtained in the present collections.

ACARTIA DANÆ, Giesbrecht.

Acartia danæ, Cleve, 1903, p. 355.
——— Cleve, 1904, p. 184.
——— Wolfenden, 1905, p. 1023.
——— A. Scott, 1909, p. 187.
——— Sewell, 1912, p. 376.

A few examples of this species were present.

Acartia erythræa, Giesbrecht.

Acartia erythræa, Giesbrecht, 1889, p. 26.
———————— Giesbrecht, 1891, p. 282.
———————— Giesbrecht, 1896, p. 317.
———————— Thompson, 1899, p. 284.
———————— Cleve, 1901, p. 4.
———————— A. Scott, 1902, pp. 408, 423.
———————— Thompson & Scott, 1903, p. 254.
———————— Cleve, 1903, p. 355.
———————— Wolfenden, 1905, p. 1023.
———————— A. Scott, 1909, p. 187.
———————— Pesta, 1912, p. 53, fig. 16.
———————— Sewell, 1912, p. 377.
———————— Pesta, 1913, p. 32.

Numerous examples of both sexes were obtained; this species is both widely distributed and of common occurrence in Indian waters.

Acartia negligens, Dana.

Acartia negligens, Cleve, 1901, p. 4.
———————— A. Scott, 1902, p. 408.
———————— Thompson & Scott, 1903, p. 254.
———————— Wolfenden, 1905, p. 1023.
———————— A. Scott, 1909, p. 188.

Examples of this species were obtained at several of the localities on the pearl banks, though in no case was it present in any considerable numbers.

Acartia spinicauda, Giesbrecht.

Acartia spinicauda, Cleve, 1901, p. 4.
———————— Cleve, 1903, p. 355.
———————— A. Scott, 1909, p. 188.
———————— Sewell, 1912, pp. 315 and 377.

Only a few examples of this species were present.

ACARTIA BISPINOSA, Carl.

Acartia bispinosa, Carl, 1907, p. 13. Pl. I., figs. 1, 2.
———————— Pesta, 1912, p. 54, fig. 17.

This species was first described by Carl from Amboina, and since then it has been recorded by Pesta from the Persian Gulf. Numerous examples were obtained in the Ceylon collections, and the specimens agree closely with previous descriptions. According to Carl and Pesta, there are only two spines on the postero-lateral thoracic margin, but this appears to be a variable character, as in some of the present examples an extra spine occurred, making three in all. Only the males of this species have up to the present time been discovered.

ACARTIA PIETSCHMANI, Pesta.

Acartia pietschmani, Pesta, 1912, p. 55, fig. 18.
———————— Pesta, 1913, p. 33.

This species was described from the Persian Gulf, where examples of the adult female and some immature males were obtained, and has since been obtained in the Arabian Sea. Several examples were found in the Ceylon collections that correspond with this form ; they at first sight are likely to be mistaken for *A. erythræa*, but they are of smaller size, and the structure of the fifth pair of legs in the female of the two species is different.

ACARTIA AMBOINENSIS, Carl.

(Pl. XIX., figs. 1–7).

Acartia amboinensis, Carl, 1907, p. 12. Pl. I., figs. 3–5.

Numerous examples were found in the present collections. This species was described by Carl from male examples only ; these very closely resemble the male of *A. erythræa*, but there are certain constant differences in the structure of the fifth pair of thoracic appendages; and on the posterior thoracic margin, in most cases, there are two small spines situated dorsally, though in some instances as many as three are present, whereas in *A. erythræa* there is only one.

Associated with these males in the present collections were numerous females.

♀. Total length, 1·2 mm.

Proportional lengths of cephalo-thorax and abdomen, 14 : 3.

The head and first thoracic segment are separate, but the last two thoracic segments are fused. The posterior thoracic margin bears a large lateral spine, as *A. erythræa*, and one, sometimes two, small spines dorsally. The rostrum consists of a pair of slender spines.

The abdomen consists of three segments having, with the furcal rami, the following proportions:—7 : 3 : 2 : 3. The first segment is armed near its posterior border with a pair of small spines dorso-laterally; the second segment is devoid of spines. The furcal setæ are all of the same thickness, but the second is somewhat longer than the others.

The first antenna, when folded back, reaches to the end of the first abdominal segment. It consists of eighteen joints, having the following proportions:—

Segments:	1.	2–4.	5–6.	7–8.	9–10.	11.	12–13.	14.	15–16.
	49	81	35	22	97	51	111	57	92
Segments:	17.	18.	19.	20.	21.	22.	23.	24.	25.
	62	57	49	46	57	32	51	38	13

The first joint bears a long straight spine on its anterior aspect, and two small spines posteriorly; the second joint bears a large curved hook on its posterior border; and the fourth joint is armed with two small spines posteriorly.

The second antenna is as figured.

The first pair of swimming legs consist of a basal portion and two-jointed exopodite and endopodite: exopod 1 has a fine seta-like marginal spine; exopod 2 bears three margin spines, the proximal of which is long and stout and reaches well beyond the end of the terminal segment, while the distal two are slender and seta-like; the end spine is slender and in length nearly equals the whole exopodite.

The third and fourth pairs of legs are very similar to *A. erythræa.*

The fifth pair of legs bear a short external seta; and the terminal process is long and curved and is very slightly swollen at the base.

These examples very closely resemble the females of *A. erythræa,* but the spinulation of the basal segments of the first antenna and the form of the fifth pair of legs are different and are quite characteristic.

ACARTIA SOUTHWELLI, sp. nov.

(Pl. XIX., figs. 8, 9.)

Several examples, both male and female, of what appears to be a new species of *Acartia* were obtained from Kilakarai. The chief characters of these specimens are as follows :—

♀. Total length, 0·8 mm.

Proportional lengths of cephalothorax and abdomen, 35 : 1.

The head and first thoracic segment are separate, but the fourth and fifth thoracic segments are fused together.

The posterior thoracic margin is rounded, and is devoid of spines. The anterior extremity is rounded, and bears a pair of slender curved rostral filaments.

The abdomen consists of three segments having, with the furcal rami, the following proportions :—26 : 13 : 10 : 15; all the segments are devoid of any trace of spines, and the genital segment is somewhat swollen and rounded. The furcal rami are nearly as wide as long, 9 : 10.

The first antennæ, when folded back, reach just beyond the posterior thoracic margin; each consists of twenty joints, the more proximal of which are, as usual, very indistinctly marked off from one another, so that it is a matter of some difficulty to determine their exact limits; they appear to have the following proportions :—

Segments :	1.	2–4.	5–6.	7–8.	9–10.	11.	12.	13–14.	15.	16.
	73	54	24	24	20	49	43	125	43	68

Segments :	17.	18.	19.	20.	21.	22.	23.	24.	25.
	58	68	49	49	49	34	63	44	20

The second antenna and *mouth-parts* are similar to other embers of the genus.

The fifth pair of legs consist of a fairly long basal joint bearing a minute seta on its external margin distally, and having a long and delicate terminal spine. This spine is curved, and has a markedly swollen base.

♂. Total length, 0·75 mm.

The proportional lengths of cephalothorax and abdomen are, 4 : 1.

The abdomen consists of four segments having, with the furcal rami, the proportional lengths :—18 : 14 : 3 : 9 : 10.

The first antenna on the right side is, as usual, modified to form a grasping organ; it consists of fifteen separate joints having the following proportions :—

Segments :	1–4.	5–6.	7–8.	9.	10.	11.	12.	13.	14.
	121	66	66	18	36	36	97	42	48

Segments :	15.	16.	17.	18.	19–21.	22–25.
	96	115	109	42	66	42

The fifth pair of legs are of the usual type; the right leg forms a claw, the second segment bears a somewhat quadrangular process on its inner border, and the third segment terminates in two short unequal spines.

Genus **Acartiella,** nov.

I propose to establish a new genus for the reception of certain *Acartia*-like species which have been obtained from Indian coastal waters. The first species I described under the name *Acartia tortaniformis* (Sewell, 1912, p. 346, Pl. XXI., figs. 1–10), from the Chittagong region and Rangoon river estuary on the coast of Burma ; a second species was obtained in a tow-netting taken off Kilakarai.

These two species differ from those of the genus *Acartia*, in that in the female the fifth pair of legs possesses both an exopodite and endopodite, and in the male the right leg forms a well-developed clasping apparatus ; in both species the rostrum is absent ; the first antenna of the female consists of

21 joints, segments 2–6 being fused together, while in the male the grasping antenna resembles that of an *Acartia ;* the abdomen is long, and terminates in two long furcal rami which are symmetrical.

ACARTIELLA KEMPI, sp. nov.

(Pl. XX., figs. 1–5, and Pl. XXI., fig. 4.)

♀. Total length, 1·0 mm.

Proportional lengths of cephalothorax and abdomen, 2·5 : 1.

The head and first thoracic segment are separate, thoracic segments 4 and 5 are fused together, the posterior thoracic margin is rounded and devoid of spines. The anterior head region is uniformly rounded, and the rostrum is absent.

The abdomen consists of three separate segments having, with the furcal rami, the following proportions :—32 : 15 : 25 : 34. The first segment is devoid of spines, thus differing from *A. tortaniformis.*

The furcal rami are long and slender as in the genus *Tortanus*, but are symmetrical.

The first antenna, when folded back, reaches to the last abdominal segment ; it consists of twenty-one separate joints, having the following proportional lengths :—

Segments :	1.	2–6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
	53	116	53	32	35	39	28	35	32	39	35

Segments :	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
	35	53	63	63	53	60	46	63	46	21

None of the segments possess spines.

The second antenna resembles that present in the genus *Acartia ;* it has a long endopodite and a short exopodite. In this respect this species differs very considerably from *Acartiella tortaniformis* (Sewell), the only other member of the genus in which this appendage is of a somewhat unusual form.

The mouth-parts and *swimming legs* closely resemble those of *A. tortaniformis.*

The fifth pair of legs consists of a short, stout, basal portion carrying a single plumose seta, and both exopodite and endopodite are present; the exopodite consists of a long slightly curved process, terminating in a sharp point and bearing a single seta-like spine on its external margin at about the junction of the middle and distal thirds; the endopodite is short and conical. There are no teeth on either ramus, as is the case in *A. tortaniformis.*

♂. Total length, 0·9 mm.

Proportional lengths of cephalothorax and abdomen, 2 : 1. The abdomen consists of five segments having, with the furcal rami, the following proportional lengths :—12 : 22 : 17 : 11 : 11 : 35.

The first antenna on the right side is modified to form a grasping organ. It consists of eighteen separate joints, having the following proportional lengths :—

Segments :	1.	2–4.	5.	6.	7.	8.	9.	10.	11.	12.
	66	84	25	11	22	33	25	40	25	33

Segments :	13.	14.	15.	16.	17.	18.	19–21.	22–25.
	44	36	44	40	76	120	131	145

The second to fourth segments inclusive are fused together to form a single joint; the " endabschnitt " consists of two joints, segments 19–21 and 22–25, respectively, being fused. The seventeenth segment bears a row of needle-like teeth on its anterior margin; the eighteenth segment bears a row of needle-like teeth anteriorly, and distally is armed with two claw-like spines, of which the proximal is the larger; the nineteenth segment carries a tooth-plate armed with acicular teeth, and the plate is produced beyond the distal extremity of the joint in a sharp *spinous* process.

The mouth-parts and *swimming legs* are the same as in the female.

The Fifth Pair of Legs.—Each consists of three segments, and that on the right side forms a well-developed grasping apparatus, as figured.

I have much pleasure in dedicating this species to Mr. S. W. Kemp, of the Indian Museum, who kindly made the collections for me at Kilakarai and Paumben, in which this species occurred.

Genus **Tortanus,** Giesbrecht.

TORTANUS GRACILIS (Brady).

(Pl. XXI., fig. 5.)

Tortanus gracilis, Cleve, 1901, p. 5. Pl. VII., figs. 11–14.
———————— A. Scott, 1902, p. 423.
———————— Thompson & Scott, 1903, p. 254.
———————— Cleve, 1903, p. 369.
———————— Wolfenden, 1905, p. 1026.
———————— A. Scott, 1909, p. 190.
———————— Sewell, 1912, p. 377.

Several examples of this species, belonging to both sexes, were present in the Ceylon collections.

Both Cleve and Wolfenden are inclined to believe that this species and the following, *T. forcipatus*, are synonymous, but a careful study of the examples in the present collection has shown that this view is absolutely untenable. For the purpose of comparison I give below a few details of structure in this species.

♀. *The first antenna* consists of seventeen joints, having the following relative proportions :—

Segments :	1–7.	8.	9–10.	11.	12.	13–14.	15.	16.	17.
	87	18	52	28	28	74	52	52	59

Segments :	18.	19.	20.	21.	22.	23.	24.	25.
	67	68	81	65	61	80	91	37

Segments 1–7, 9–10, and 13–14 are, apparently, respectively fused together. The fifth pair of legs, as pointed out by Cleve (*loc. cit.*, 1901), are asymmetrical, but the degree of asymmetry is very slight, and not in the least comparable to that present in the corresponding appendages in *T. forcipatus*.

♂. *The grasping antenna* consists of sixteen joints, having the following proportional lengths :—

Segments :	1–5.	6.	7.	8.	9.	10.	11.	12.
	62	11	19	16	30	27	24	24

Segments :	13.	14.	15.	16.	17.	18.	19–21.	22–25.
	49	67	67	62	76	81	133	252

The fifth pair of legs correspond exactly with the description and figures given by Cleve (*loc. cit.*, 1901).

TORTANUS FORCIPATUS (Giesbrecht).

(Pl. XXI., fig. 6.)

Tortanus forcipatus, Thompson & Scott, 1903, p. 254.

This species was first described by Giesbrecht from female examples only. In the present collection numerous examples were found, and associated with them were several examples of a hitherto undescribed male, which I have no doubt is the unknown male of this species.

♂. Total length.

Proportional lengths of cephalothorax and abdomen, 5 : 3. The head and all the thoracic segments are separate. The abdomen consists of five segments having, with the furcal rami, the following proportional lengths :—14 : 15 : 12 : 9 : 13 : 70. In *T. gracilis* the corresponding proportional lengths are: 14 : 14 : 11 : 8 : 15 : 72. The furcal rami are symmetrical ; four furcal setæ arise from the distal end of the ramus, and of these the second is the longest. The fifth seta is quite short, and arises from the lateral border.

The grasping antenna consists of sixteen joints, having the following proportional lengths :—

Segments :	1–5.	6.	7.	8.	9–10.	11.	12.	13.
	114	13	20	20	26-29	23	23	43

Segments :	14.	15.	16.	17.	18.	19–21.	22–25
	62	59	62	75	98	150	183

So far as its structure is concerned, the grasping antenna very closely resembles that of *T. gracilis* : segments 17, 18, and 19-21 are all armed with rows of needle-like teeth.

The fifth pair of legs show distinct differences from the corresponding appendages of *T. gracilis ;* these can best be seen by comparing the figures given.

♀. In the female *T. forcipatus* the first antenna consists apparently of seventeen joints, having the following proportional lengths :—

Segments :	1–7.	8.	9–10.	11.	12.	13–14.	15.	16.
	99	23	57	28	28	51.	42	48

Segments :	17.	18.	19.	20.	21.	22.	23.	24.	25.
	54	59	68	82	71	71	79	92	48

The fifth pair of legs are markedly asymmetrical and correspond exactly with the figure given by Giesbrecht (1893, Pl. 31, fig. 15).

The occurrence of the hitherto unknown male is of interest and the differences that it presents to the male of *T. gracilis* show that these two forms are undoubtedly different species.

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APPENDIX.

List of Collecting Stations.

Kilakarai.

12/20–2–13	Tow-net in shallow water, 0–2 fathom.
13–2–13	Tow-net from weeds.
,,	Tow-net from weeds in 2 ft. of water.
,,	Tow-net from weeds over shallow water.
,,	Tow-net over weeds, 4 ft. of water.
17–2–13	⌓ net in 3 fathoms.
,,	Tow net over 3 fathoms of water.

Between Kilakarai and Apa Island.

14–2–13	Tow net over 2 to 3 fathoms.

Paumben.

22–2–13	Tow-net over 4 ft. of water.
,,	⌓ net in 2 ft. of water through "Yostera" bed.
24–2–13	Surface tow-net.
25–2–13	⌓ net, on shelly ground in 1 fathom.

Anaivilundan Paar.

Date.	Time.	Depth in Fathoms of Net.	Position.
8–11–08	7.30 A.M.	0	—
13–11–08	8 A.M.	0	Dutch Anaivilundan.

Nadukudda Paar.

4–11–08	12 noon	0	—
4–11–08	5 P.M.	0	—
5–11–08	8 A.M.	0	—
5–11–08	12 noon	0	—
6–11–08	7.30 A.M.	0	West side.
14–11–08	12.30 P.M.	0	Dutch Nadukudda.

Koopay Paar.

11–11–08	12 noon	0	—
11–11–08	5 P.M.	0	—
12–11–08	8.30 A.M.	0	South.
4–11–08	5 P.M.	0	West.

Vankalai Paar.

Date.	Time.	Depth in Fathoms of Net.	Position.
11–4–07	5–5.30 P.M.	6	—
30–10–08	8 A.M.	0	—
30–10–08	5 P.M.	0	—
31–10–08	7.30 A.M.	0	—
31–10–08	12 noon	0	—
31–10–08	5 P.M.	0	—
15–10–08	8.30 A.M.	0	1½ mile W.N.W.
15–11–08	5 P.M.	0	do.
16–11–08	8.30 A.M.	0	2½ miles N.N.W.

Periya Paar.

7–2–08	8–8.30 A.M.	0	South end.
7–2–08	8–8.30 A.M.	6	South end.
22–2–08	8 A.M.	0	—
17–11–08	5.30 P.M.	0	—
18–11–08	7.30 A.M.	0	1 mile W. by S.
19–11–08	12 noon	0	1½ mile N. by W.
19–11–08	5 P.M.	0	2½ miles N.W.
20–11–08	12 noon	0	2½ miles N. by W.
20–11–08	5.30 P.M.	0	2½ miles W.S.W.
22–11–08	5.30 P.M.	0	—
23–11–08	8 A.M.	0	South shoal.

Periya Paar Karai.

9–4–07	5–5.30 P.M.	6	—
10–4–07	8–8.30 A.M.	0	—
11–4–07	8–8.30 A.M.	6	—
17–11–08	8.30 A.M.	0	—
17–11–08	12 noon	0	—

Aripu Paar East.

3–12–08	8 A.M.	0	—

North Cheval Paar.

9–4–07	8–8.30 A.M.	6	—
7–11–07	4–4.30 P.M.	0	—
7–11–07	4–4.30 P.M.	5	—
19–11–07	8–8.30 A.M.	6	—

North-East Cheval Paar.

6–11–07	8–8.30 A.M.	0	—
6–11–07	8–8.30 A.M	5	—
6–11–07	4–4.30 P.M.	0	—
7–11–07	8–8.30 A.M.	0	—
7–11–07	8–8.30 A.M.	5	—
20–11–07	8–8.30 A.M.	0	—

Date.	Time.	Depth in Fathoms of Net.	Position.
8-11-08	7.30 A.M.	0	—
27-11-08	5.30 P.M.	0	—
28-11-08	7.30 A.M.	0	—
Mid-East Cheval Paar.			
7-2-07	5-5.30 P.M.	0	—
8-2-07	8-8.30 A.M.	0	—
8-2-07	12-12.30 P.M.	0	—
8-2-07	12-12.30 P.M.	6	—
3-11-07	4-4.30 P.M.	0	—
4-11-07	8-8.30 A.M.	0	—
4-11-07	8-8.30 A.M.	4	—
4-11-07	4-4.15 P.M.	0	—
4-11-07	4-4.15 P.M.	4	—
5-11-07	8-8.30 A.M.	0	—
5-11-07	8-8.30 A.M.	4	—
20-11-07	4-4.30 P.M.	0	—
21-11-07	8-8.30 A.M.	0	East side.
3-2-08	4-4.30 P.M.	0	do.
18-2-09	7.30 A.M.	0	—
South-East Cheval Paar.			
6-2-07	5-5.30 P.M.	0	—
7-2-07	8-8.30 A.M.	0	—
23-11-07	8-8.30 A.M.	0	North edge.
16-2-09	5.30 P.M.	0	—
16-2-09	5.30 P.M.	6	—
South Cheval Paar.			
19-2-09	5 P.M.	6	—
20-2-09	7 A.M.	0	—
20-2-09	7 A.M.	6	—
South-West Cheval Paar.			
20-2-09	5.30 P.M.	0	—
21-2-09	7.30 A.M.	6	—
21-2-09	12 noon	0	—
Mid-West Cheval Paar.			
22-1-07	3.45-4 P.M.	6	—
23-1-07	8-9 A.M.	6	—
23-1-07	12.30-1 P.M.	6	—
23-1-07	5-5.45 P.M.	6	—
24-1-07	8-9 A.M.	0	—
24-1-07	8-9 A.M.	6	—
24-1-07	12.30-1.30 P.M.	0	—

Date.	Time.	Depth in Fathoms of Net.	Position.
25–1–07	8–9 A.M.	0	West edge.
25–1–07	8–9 A.M.	$8\frac{3}{4}$	do.
6–2–07	12–12.30 P.M.	0	—
9–2–07	8–8.30 A.M.	0	—
9–2–07	8–8.30 A.M.	6	—
30–3–07	8–8.30 A.M.	0	—
30–3–07	8–8.30 A.M.	6	—
30–3–07	5–5.30 P.M.	0	—
30–3–07	5–5.30 P.M.	6	—
31–3–07	8–8.30 A.M.	0	—
31–3–07	8–8.30 A.M.	6	—
31–3–07	5–5.30 P.M.	6	—
1–4–07	8–8.30 A.M.	0	—
1–4–07	8–8.30 A.M.	6	—
1–4–07	5–5.30 P.M.	6	—
2–4–07	8–8.30 A.M.	0	—
2–4–07	8–8.30 A.M.	6	—
6–2–08	8–8.30 A.M.	0	—
	West Cheval Paar.		
28–11–07	8–8.30 A.M.	0	—
28–11–07	8–8.30 A.M.	6	—
	North-West Cheval Paar.		
4–2–08	4–4.30 P.M.	0	—
	Mid-Cheval Paar.		
4–2–08	8–8.30 A.M.	0	East side.
	North-Central Cheval Paar.		
26–11–08	12 noon	0	—
26–11–08	5.30 P.M.	0	—
27–11–08	8 A.M.	0	—
	Challai Paar.		
1–2–08	8–8.30 A.M.	0	—
1–2–08	4–4.30 P.M.	0	1 mile west.
2–2–08	8–8.30 A.M.	0	do.
3–2–08	8–8.30 A.M.	0	3 miles west.
	Silavatturai Paar.		
28–3–09	12 noon	0	—
	Kondachi Paar.		
21–10–08	8 A.M.	0	—
22–10–08	8–8.30 A.M.	0	—
29–10–08	8 A.M.	0	Near to.

Date.	Time.	Depth in Fathoms of Net.	Position.
	Jaggerboom Bank.		
22–2–09	7 30 A.M.	0	—
	Moderagam Paar.		
6–4–07	5–5 30 P.M.	0	South.
6–4–07	5–5.30 P.M.	6	do.
7–4–07	8–8.30 A.M.	0	do.
7–4–07	8–8.30 A.M.	6	do.
28–11–07	4–4.40 P.M.	0	do.
29–11–07	8–8.30 A.M.	0	do.
29–11–07	8–8.30 A.M.	5	do.
14–2–08	4–4.30 P.M.	6	North end.
17–2–08	4–4.30 P.M.	0	do.
14–2–09	12 noon	0	North.
14–2–09	5.30 P.M.	0	do.
15–2–09	7.30 A.M.	0	do.
15–2–09	5.30 P.M.	0	—
15–2–09	5.30 P.M.	6	—
16–2–09	7.30 A.M.	0	South.
	Old Dutch Jaggerboom Bank.		
10–2–09	5 P.M.	0	—
10–2–09	5 P.M.	6	—
11–2–09	7.30 A.M.	0	—
11–2–09	12 noon	0	—
	Marichchukkaddi Bay.		
10–2–07	8–8.30 A.M.	0	—
11–2–07	8–8.30 A.M.	0	—
12–2–07	8–8.30 A.M.	0	—
13–2–07	8–8.30 A.M.	0	—
14–2–07	7.30–8 A.M.	0	—
17–2–07	7.30–8 A.M.	0	—
18–2–07	7.30–8 A.M.	0	—
14–11–07	3.45–4 P.M.	0	—
10–2–08	8–8.30 A.M.	0	2 miles out.
	Kudrimalai Paar.		
11–2–08	10–10.30 A.M.	0	—
	Dutch Moderagam Paar.		
27–1–07	5.30–6 P.M.	6	—
28–1–07	8–8.30 A.M.	6	—
28–1–07	12–12.30 P.M.	0	—
28–1–07	12–12.30 P.M.	6	—
28–1–07	5–5.30 P.M.	0	—
28–1–07	5–5.30 P.M.	6	—
29–1–07	8–8.30 A.M.	0	—
29–1–07	8–8.30 A.M.	6	—
20–2–07	7.30–8 A.M.	0	—

Date.	Time.	Depth in Fathoms of Net.	Position.
20–2–07	7.30–8 A.M.	6	—
20–2–07	5–5.30 P.M.	6	—
21–2–07	5–5.30 P.M.	0	—
21–2–07	5–5.30 P.M.	6	—
22–2–07	8–8.30 A.M.	0	—
22–2–07	8–9 A.M.	0	—
22–2–07	5–5.30 P.M.	0	—
22–2–07	5–5.30 P.M.	6	—
23–2–07	8–9 A.M.	6	—
23–2–07	5–5.30 P.M.	0	—
24–2–07	8–8.30 A.M.	0	—
24–2–07	8–8.30 A.M.	6	—
24–2–07	12–12.30 P.M.	0	—
24–2–07	5–5.30 P.M.	0	—
24–2–07	5–5.30 P.M.	6	—
25–2–07	8–8.30 A.M.	0	—
25–2–07	5–5.30 P.M.	0	—
25–2–07	5–5.30 P.M.	6	—
26–2–07	8–8.30 A.M.	0	—
26–2–07	5–5.30 P.M.	0	—
26–2–07	5–5.30 P.M.	6	—
27–2–07	8–8.30 A.M.	6	—
27–2–07	5–5.30 P.M.	0	—
27–2–07	5–5.30 P.M.	6	—
28–2–07	8.8.30 A.M.	0	—
28–2–07	5–5.30 P.M.	0	—
1–3–07	8–8.30 A.M.	0	—
1–3–07	8–8.30 A.M.	6	—
1–3–07	5–5.15 P.M.	0	—
2–3–07	5–5.15 P.M.	0	—
2–3–07	5–5.15 P.M.	6	—
3–3–07	8–8.30 A.M.	6	—
9–2–09	7 A.M.	0	—
10–2–09	12 noon	0	1½ mile to the east.
10–2–09	12 noon	6	do.
13–2–09	7.30 A.M.	6	Old Dutch site.

Karaitivu Paar.

Date.	Time.	Depth in Fathoms of Net.	Position.
14–11–06	9 A.M.	0	—
14–11–06	9 A.M.	6	—
26–1–07	12–12.30 P.M.	0	—
29–1–07	5–5.30 P.M.	0	—
30–1–07	12–12.30 P.M.	0	—
30–1–07	5–5.30 P.M.	6	—
31–1–07	8–8.30 A.M.	0	—
31–1–07	12–12.30 P.M.	6	—
4–3–07	5–5.30 P.M.	0	—
4–3–07	5–5.30 P.M.	6	—
5–3–-07	8–8.30 A.M.	0	—

Date.	Time.	Depth in Fathoms of Net.	Position.
5–3–07	8–8.30 A.M.	6	—
5–3–07	5–5.30 P.M.	0	—
5–3–07	5–5.30 P.M.	6	—
6–3–07	8–8.30 A.M.	0	—
6–3–07	5–5.30 P.M.	6	—
8–3–07	8–8.30 A.M.	0	—
8–3–07	8–8.30 A.M.	6	—
14–3–07	5–5.30 P.M.	0	—
14–3–07	5–5.30 P.M.	6	—
15–3–07	8–8.30 A.M.	6	—
15–3–07	5–5.30 P.M.	6	—
16–3–07	8 A.M.	0	—
16–3–07	8 A.M.	6	—
18–3–07	5–5.30 P.M.	6	—
19–3–07	8 A.M.	6	—
20–3–07	8–8.30 A.M.	0	—
20–3–07	5–5.30 P.M.	6	—
21–3–07	8–8.30 A.M.	0	—
21–3–07	8–8.30 P.M.	6	—
21–3–07	5–5.30 P.M.	0	—
14–2–08	4–4.30 P.M.	0	—
14–2–08	4–4.30 P.M.	6	—
15–2–08	8–8.30 A.M.	0	—
7–2–09	7 A.M.	0	2½ miles to the eastward.
Karaitivu Shoal, North End.			
1–11–07	4–4.30 P.M.	0	—
1–11–07	4–4.30 P.M.	4	—
2–11–07	8–8.45 A.M.	0	—
2–11–07	8–8.45 A.M.	4	—
2–11–07	4–4.45 P.M.	0	—
2–11–07	4–4.45 P.M.	4	—
Alanturai Paar.			
2–1–07	8–8.30 A.M.	0	—
2–1–07	8–8.30 A.M.	6	—
2–1–07	12–12.30 P.M.	0	—
1–2–07	8–8.30 A.M.	0	—
1–2–07	12–12.30 P.M.	0	—
1–2–07	12–12.30 P.M.	6	—
1–2–07	5–5.30 P.M.	0	—
1–2–07	5–5.30 P.M.	6	—
2–2–07	5–5.30 P.M.	0	—
3–2–07	8–8.30 A.M.	6	—
12–3–07	5–5.30 P.M.	6	—
13–3–07	5–5.30 P.M.	0	—
13–3–07	5–5.30 P.M.	6	—
14–3–07	8–8.30 A.M.	0	—
14–3–07	8–8.30 A.M.	6	—

Date.	Time,	Depth in Fathoms of Net.	Position.
27–3–07	8–8.30 A.M.	0	—
27–3–07	8–8.30 A.M.	6	—
27–3–07	5–5.30 P.M.	6	—
28–3–07	8–8.30 A.M.	0	—
28–3–07	5–5.30 P.M.	0	—
13–4–07	5–5.30 P.M.	0	—
13–4–07	5–5.30 P.M.	6	—
14–4–07	8–8.30 A.M.	0	—
14–4–07	8–8.30 A.M.	6	—
16–4–07	5–5.30 P.M.	0	—
17–4–07	8–8.30 A.M.	0	—
17–4–07	5–5.30 P.M.	0	—
18–4–07	8–8.30 A.M.	0	—
18–4–07	5–5.30 P.M.	6	—
19–4–07	8–8.30 A.M.	6	—
1–2–09	7.30 A.M.	0	—
1–2–09	12.30 P.M.	0	—
4–2–09	5.30 P.M.	0	—
5–2–09	12 noon	0	—
8–2–09	7 A.M.	0	½ mile to the north.
8–2–09	12 noon	0	do.

Muttuvaratu Paar.

19–11–06	—	0	—
20–11–06	—	6	—
21–11–06	—	0	—
22–11–06	—	0	—
5–2–07	12–12.30 P.M.	0	—
(?)–2–07	12–12.30 P.M.	(?)	—
22–3–07	5–5.30 P.M.	6	—
23–3–07	8–8.30 A.M.	6	—
26–3–07	8–8.30 A.M.	0	—
18–2–08	8–8.30 A.M.	0	North end.
18–2–08	8–8.30 M.A.	6	do.
27–1–09	7.30 A.M.	0	—
27–1–09	9.30 A.M.	0	—
27–1–09	5.30 P.M.	0	—
28–1–09	12 noon	0	—
28–1–09	5.30 P.M.	0	1½ mile to the east.
29–1–09	7.30 A.M.	0	do.

Donnan's Muttuvaratu Paar.

3–2–09	7.30 A.M.	0	—
3–2–09	12 noon	0	North end.

Hamilton's Muttuvaratu Paar.

1–2–09	5.30 P.M.	0	—
2–2–09	12.30 P.M.	0	—
4–2–09	7.30 A.M.	0	1½ mile to the west.
4–11–09	12 noon	0	do.

Date.	Time.	Depth in Fathoms of Net.	Position.
5–2–09	5 P.M.	0	1½ mile to the east.
6–2–09	7 A.M.	0	do.
6–2–09	12 noon	0	do.
		Krusadai Paar.	
14–11–06	(?)	6	—
17–11–06	(?)	1	—
19–11–06	(?)	1	—
25–11–07	8–8.30 A.M.	0	—
25–11–07	8–8.30 A.M.	5	—
26–11–07	8–8.30 A.M.	0	—
26–11–07	4–4.30 P.M.	5	West side.
27–11–07	8–8.30 A.M.	5	do.
15–2–08	4–4.30 P.M.	0	—
15–2–08	4–4.30 P.M.	6	—
16–2–08	8–8.30 A.M.	0	—
16–2–08	4–4.30 P.M.	0	South side.
17–2–08	8–8.30 A.M.	0	do.
		Dutch Bay Spit.	
30–1–09	5 P.M.	0	4½ miles north.
31–1–09	7.30 A.M.	0	do.
31–1–09	12 noon	0	4½ miles west.
		Talaivillu Paar.	
4–3–09	5.30 P.M.	0	—
5–3–09	7.30 A.M.	0	—
5–3–09	5.30 A.M.	6	—
		Navakkaduwa Paar.	
5–3–09	5.30 P.M.	0	—
6–3–09	7.30 A.M.	0	—
		Jokenpiddi Paar.	
11–3–09	7.30 A.M.	0	—
11–3–09	7.30 A.M.	6	—
		Karkopanni Paar.	
7–3–09	7.30 A.M.	0	—
		Chilaw.	
9–3–09	5.30 P.M.	0	—
		Nadalaikula Paar.	
4–3–09	7.30 A.M.	0	—
4–3–09	7.30 A.M.	6	—
		Bar Reef.	
29–1–09	5 P.M.	0	2½ miles north.
30–1–09	7.30 A.M.	0	—
—	12 noon	0	—

EXPLANATION OF PLATES.

Plate XVII.

1.	*Undinula vulgaris* (Dana), var.	Left posterior thoracic margin, lateral view.
2.	*Undinula vulgaris* (Dana), var.	Left posterior thoracic margin, dorsal view.
3.	*Acrocalanus similis*, sp. nov.	♀, 3rd leg.
4.	*Acrocalanus similis*, sp. nov.	♀, 4th leg.
5.	*Acrocalanus similis*, sp. nov.	♂, 5th leg.
6.	*Scolecithricella pearsoni*, sp. nov.	♀, dorsal view.
7.	*Scolecithricella pearsoni*, sp. nov.	♀, 1st leg.

Plate XVIII.

1.	*Scolecithricella pearsoni*, sp. nov.	♀, 2nd leg.
2.	*Scolecithricella pearsoni*, sp. nov.	♀, 3rd leg.
3.	*Scolecithricella pearsoni*, sp. nov.	♀, 5th leg.
4.	*Scolecithricella pearsoni*, sp. nov.	♂, 5th pair of legs.
5.	*Centropages trispinosus*, sp. nov.	♀, lateral view.
6.	*Centropages trispinosus*, sp. nov.	♀, 1st antenna.
7.	*Centropages trispinosus*, sp. nov.	♀, 2nd leg.
8.	*Centropages trispinosus*, sp. nov.	♀, 5th leg.

Plate XIX.

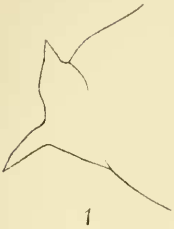
1.	*Acartia amboinensis*, Carl	♀, lateral view.
2.	*Acartia amboinensis*, Carl	♀, abdomen, dorsal view.
3.	*Acartia amboinensis*, Carl	♀, 1st antenna, basal joints.
4.	*Acartia amboinensis*, Carl	♀, Maxilliped.
5.	*Acartia amboinensis*, Carl	♀, 1st leg.
6.	*Acartia amboinensis*, Carl	♀, 3rd leg.
7.	*Acartia amboinensis*, Carl	♀, 5th leg.
8.	*Acartia southwelli*, sp. nov.	♂, 5th pair of legs.
9.	*Acartia southwelli*, sp. nov.	♀, 5th leg.

Plate XX.

1.	*Acartiella kempi*, gen. nov.; sp. nov.	♀, lateral view.
2.	*Acartiella kempi*, gen. nov.; sp. nov.	♀, 1st antenna.
3.	*Acartiella kempi*, gen. nov.; sp. nov.	♂, 1st antenna.
4.	*Acartiella kempi*, gen. nov.; sp. nov.	♀, 2nd leg.
5.	*Acartiella kempi*, gen. nov.; sp. nov.	♂, 5th pair of legs.

Plate XXI.

1.	*Labidocera pavo*, Giesbrecht	♂, dorsal view.
2.	*Labidocera pavo*, Giesbrecht	♂, grasping antenna.
3.	*Labidocera pavo*, Giesbrecht	♂, 5th pair of legs.
4.	*Acartiella kempi*; gen. nov.; sp. nov.	♀, 5th pair of legs.
5.	*Tortanus gracilis* (Brady)	♂, 5th pair of legs.
6.	*Tortanus forcipatus* (Giesbrecht)	♂, 5th pair of legs.



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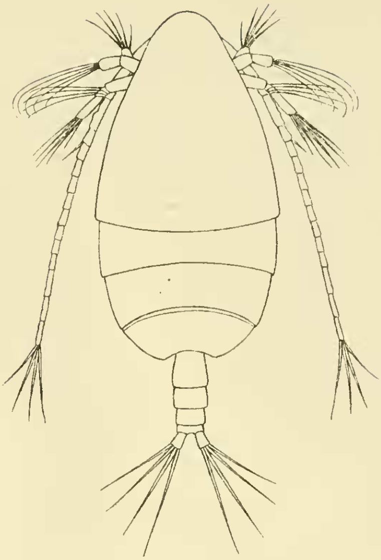

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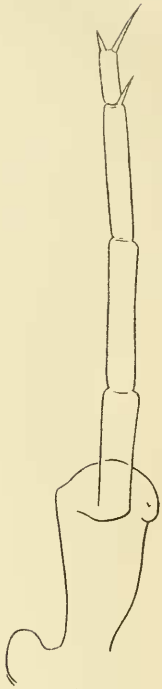

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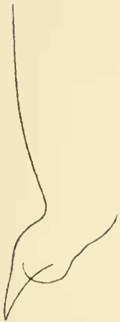

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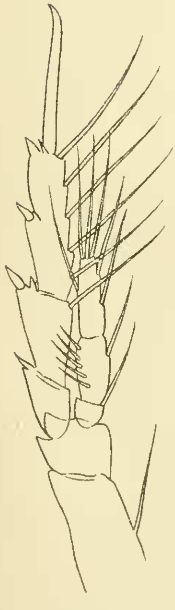

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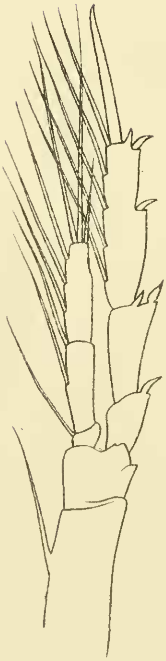

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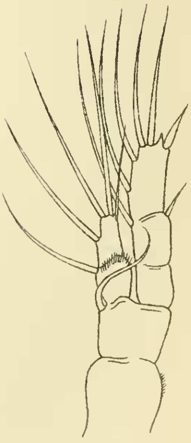

7.

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Life colors, according to Dr. H. M. Smith, "light brown above; belly cream color."

The *young*, as shown by a specimen in our collection from Shikoku (U.S.N.M. No. 31850) only 155 mm. in total length, is essentially as the adult; the ground color, however, is darker and there are two distinct series of numerous roundish, pale, dark-edged dots, located on the fifth and sixth scale-rows on each side.

Variation.—A noteworthy variation in this species is the occasional joining of the parietal to one of the supralabials, noteworthy particularly because it was the condition found in Boie's type. In two of our specimens (No. 30730, from Kiusiu, and No. 34028, from Mount Fuji) the contact is between the parietal and the sixth supralabial behind the first temporal, and in another specimen (No. 34029) there is such a contact on one side. The number of preoculars varies to some extent, but one is the normal number, not a single specimen of the 22 before me having more. Strauch, on the other hand, found two out of four specimens. Altogether, his series was extraordinarily variable, as their postoculars varied between two, three, and two and three, while the supralabials showed the unusual variation of coalescing to the extent of being reduced to six, or even five. We have 12 with three postoculars, 4 with two and 3, and 3 with two, while all have 7 supralabials except three, which have 8 on one side, and one (No. 34034*a*) which has 8 on both sides. This additional labial is interpolated in front of the eye, and in one of the specimens the interpolation occurs on both sides, but the normal number of 7 is restored on one side by the coalescing of two labials behind the eye.[a]

Remarks.—The relationship of this species to *Natrix khasiensis*, from Assam, and *N. craspedogaster*, from Fokien, has been alluded to above (p. 264). It is not only shown in the unmistakable pattern of the upper lip and its continuation in the nuchal crescent, but also in the postparietal median light streak and in the series of white spots on the body of *N. craspedogaster* and the young *N. vibakari* described above (p. 268). About the relationships with *N. pryeri*, see under the latter species (p. 286).

Habitat.—Common thoughout Japan from Kiusiu to Yezo. Doctor Nozawa has informed me that it occurs in the latter island, but he has sent no specimen as yet. Numerous specimens from the neighborhood of Tokyo, Yokohama, and Nagasaki are in the various museums, as well as some from Kobe, Miyazaki, and other places.

Outside of Japan it has been found in the Russian Coast Province from Possiet Bay, on the Korean frontier (Mus. St. Petersburg), to Vladivostok (Hamburg Mus. No. 2170) and Khabarovka, at the junction of the Ussuri with the Amur (Brit. Mus.). In 1885 Jouy

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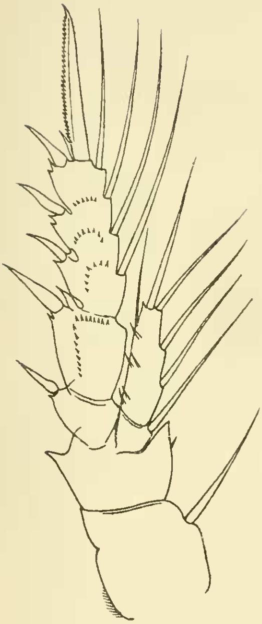
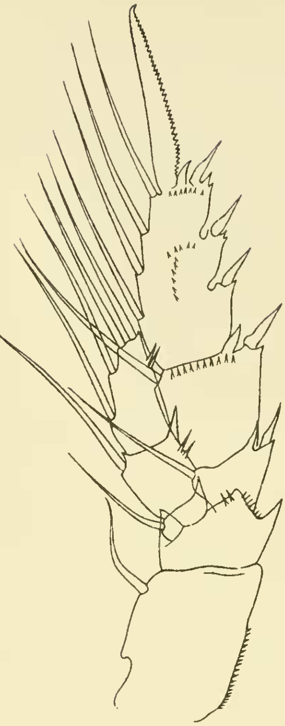
[a] For further variations see Wall, Proc. Zool. Soc. London, 1905, II, p. 513.





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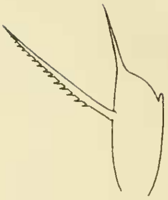

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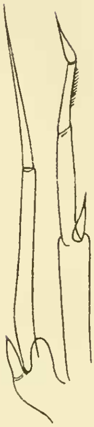

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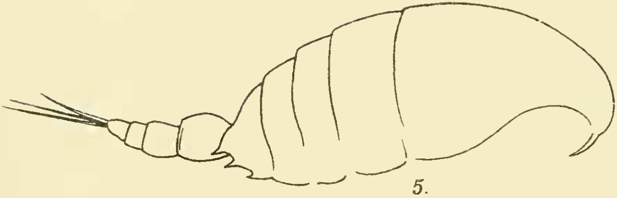

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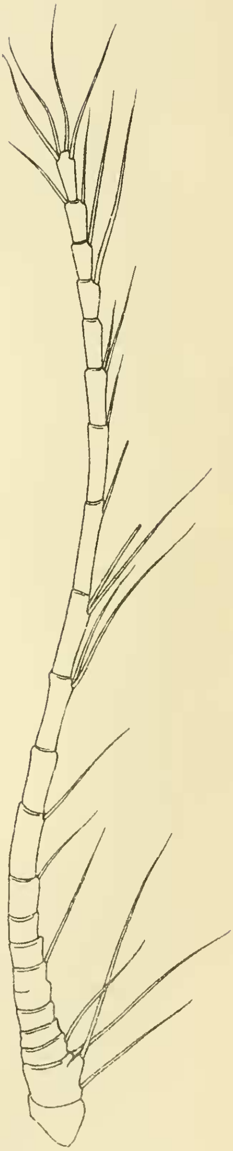

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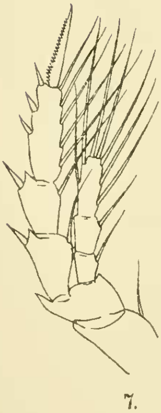

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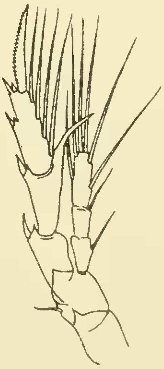

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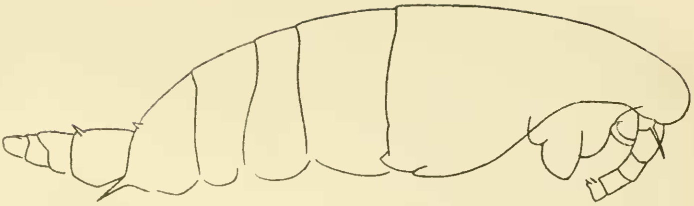
List of specimens of Natrix vibakari.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
U.S.N.M.	11327	Female	Japan	1878	E. S. Morse	19	148	2	71	1,3	1+1	7
Do	11328	Male	do	1878	do	19	151	2	73	1,2—3	1+2	7
Do	11329	do	do	1878	do	19	146	2	70	1,3	1+1—2	7
Do	11330	Young	do	1878	do	19	147	2	73	1,3	1+2	7
Do	11331	Female	do	1878	do	19	146	2	63	1,3	1+1	7
Do	17510	do	Fusan, Korea	1885	P. L. Jouy	19	148	2	58	1,2	1+1	7
Do	23335	Male [a]	Yokohama	Sept. —, 1896	L. Stejneger	19	146	2	73	1,3	1+1—2	7—8
Do	30730	Female	Miyazaki, Kiusiu		C. A. Clark	19	146	2	72	1,3	1+2	7
Do	31850	Young	Suzaki, Tosa, Shikoku	May 8, 1903	Dr. H. M. Smith	19	148	2	79	1,3	2+2	8
Do	31858	Male	Kochi, Shikoku	May 11, 1903	do	19	147	2	83	1,3—4	1+2	7—8
Do	31859	Young	do	do	do	19	141	2	74	1,3	1+2	7
Do	34028	Female	Mount Fuji	Aug. —, 1898	A. Owston	19	147	2	74	1,2—3	1+2	7
Do	34029	do	do	do	do	19	149	2	74	1,3	1+1	7—8
Do	34030	do	do	do	do	19	150	2	75	1,3	1+2	7
Do	34031	do	do	do	do	19	145	2		1,2—3	1+2	7
Do	34032	Male	do	do	do	19	148	2	79	1,2	1+1	7
Do	34033	do	do	do	do	19	147	2	80	1,2—3	1+2	7
Do	34034	Young	do	do	do	19	145	2	78	1,3	1+1	7
Do	34034*a*	do	do	do	do	19	145	2	78	1,3	1—2+1—2	8
Do	36543	Female [b]	Tokyo		Sci. Coll. Tokyo	19	147	2		1,3	1+2	7
Do	36544	Male [b]	do		do	19	151	2	70	1,2	1+2	7—8
Do	36545	do. [b]	do		do	19	150	2	74	1,3	1+1	7
Do	36546	Young [b]	do		do							
Brit. Mus.	*c*	do. [c]	Japan		A. Adams	19	137	2	62			
Do	*d*	do. [c]	do		do	19	137	2	65			
Do	*e*	Male [c]	do		Museum, Leiden	19	148	2	74			
Do	*f*	Female [c]	do		do	19	144	2	79			
Do	*h*	Male [c]	do		Doctor Bleeker	19	148	2				
Do	*i*	Female [c]	Yokohama		Challenger Exped	19	144	2	68			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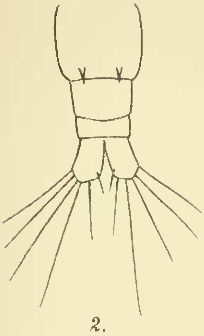
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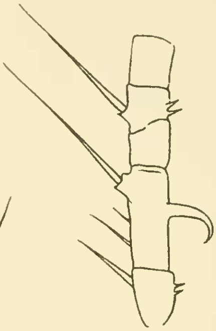
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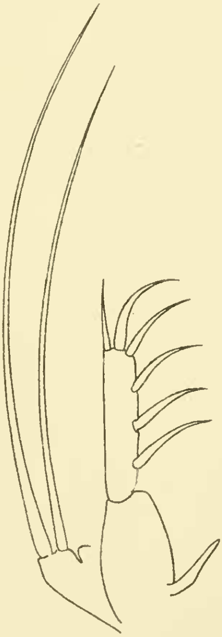
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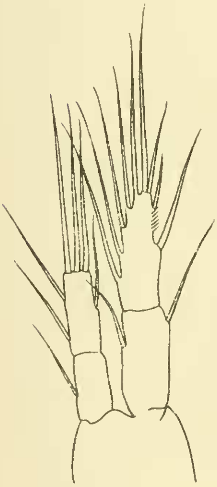
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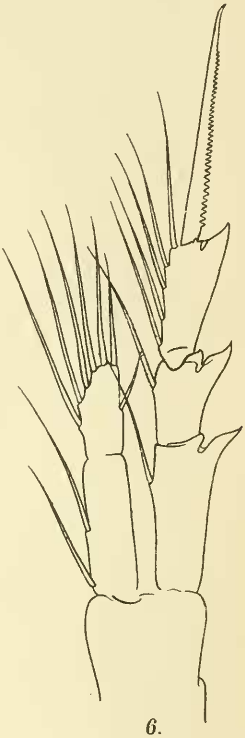
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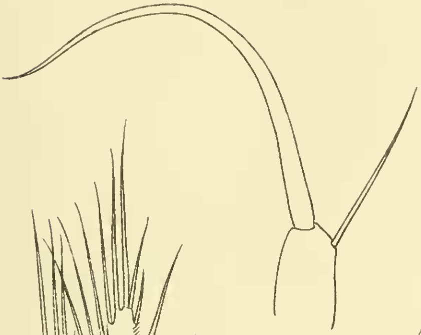
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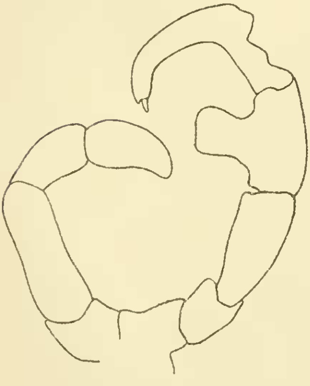
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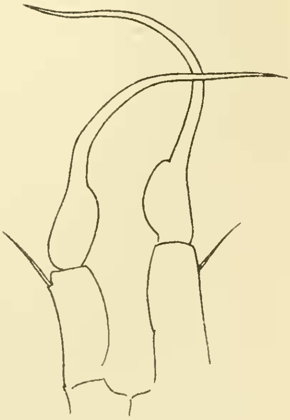
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NATRIX TIGRINA[a] (Boie).

YAMA GAMISHI.

Plate XIX.

1826. *Tropidonotus tigrinus* Boie, Isis, 1826, p. 205 (type-locality, Japan; Blomhoff, collector); Bijdr. Natuurk. Wetensch., II, Pt. 1, 1827, p. 250.—Temminck and Schlegel, Fauna Japon., Rept., 1837, pp. 85, 139; Ophid., pl. IV[b] (Japan.)—Schlegel, Phys. Serp., II, 1837, p. 315 (Japan).—Guenther, Cat. Colubr. Sn. Brit. Mus., 1858, p. 71 (part: Japan); Rept. Brit. India, 1864, p. 271 (part: Japan).—Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 110 (Yokohama); 1876, p. 379 (Tokyo, Nagasaki).—Strauch, Mém. Acad. Sci. St. Pétersb. (7), XXI, no. 4, 1873, pp. 176, 277 (part: Japan).—Hilgendorf, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, 1876, p. 30 (Tokyo); Sitz. Ber. Naturf. Fr. Berlin, 1880, p. 115 (Tokyo).—Boulenger, Cat. Snakes Brit. Mus., I, 1893, p. 249 (part: Kobe), III, 1896, p. 607 (Shimabara).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V., 1891; p. 239 (not in Yezo).—Okada, Cat. Vert. Jap., 1891, p. 68 (Tokyo; Nikko; Osaka; Suwo; Awachi; etc.).—Boettger, Kat. Schl. Mus. Senckenberg, 1898, p. 25 (part: Nikko; Yokohama; Yezo).—Wall, Proc. Zool. Soc. London, 1903, p. 99 (Japan); 1905, II, p. 513 (Yaku I., Tanega I.).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, 1905, p. 222 (Nagasaki; Unzen).—*Amphiesma tigrinum* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, 1854, p. 732 (Japan.)—Bleeker, Natuurk. Tijdschr. Nederland. Indië, XVI, 1858, p. 204 (Japan).—Hallowell, Proc. Phila. Acad., 1860, p. 499 ([Simoda] Hondo).

Description (figs. 242–243).—*Adult male;* U.S.N.M. No. 31846; Sendai, province of Satsuma, Kiusiu; June 4, 1903; Dr. H. M. Smith, collector. Rostral much broader than high, well visible from above; internasals somewhat smaller than prefontals, truncate in front, the suture with rostral slightly longer than the suture of rostral with first supralabial; prefrontals in contact with supraoculars; frontal much broader than supraoculars, about as long as its distance from tip of snout and as interparietal suture; parietals about as long as distance of eye from tip of snout; nostril lateral, large, between two nasals, of which the posterior is higher than the anterior; loreal pentagonal, as high as long; two preoculars, the upper not in contact with frontal; three postoculars; temporals 1+2, those of the second row being abnormally fused on the left side; 7 supralabials, fifth and sixth largest, fourth and fifth entering eye; 5 lower labials in contact with anterior chin-shields, which are considerably shorter than posterior; 19 rows of long, narrow, strongly keeled scales, each with two large oval apical pits same distance from the tip; 161 ventrals; anal divided; 83 pairs of subcaudals. Color (in alcohol)[c] above tawny-

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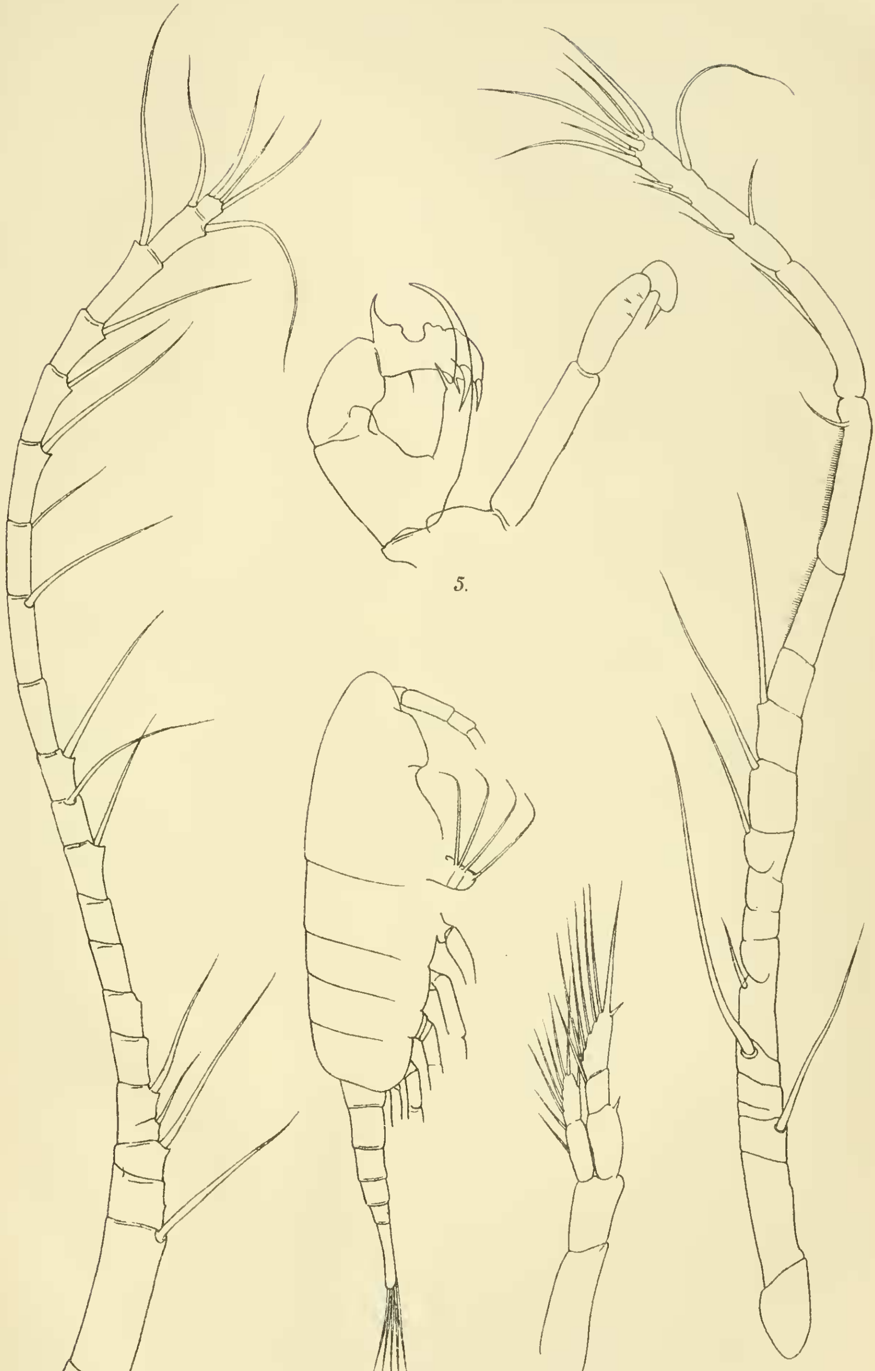
[a] Signifying tiger-like, probably with reference to the red and black spots on the sides. According to von Siebold this species is in Japan also called *Torano Kuchinaha*, and according to von Martens, *Torasuhebi*, both meaning tiger snake.

[b] Reproduced in this work on Plate XIX.

[c] In life, according to Dr. H. M. Smith, these snakes are "greenish above, with black and orange blotches intermingled; head greenish above; belly slate color."



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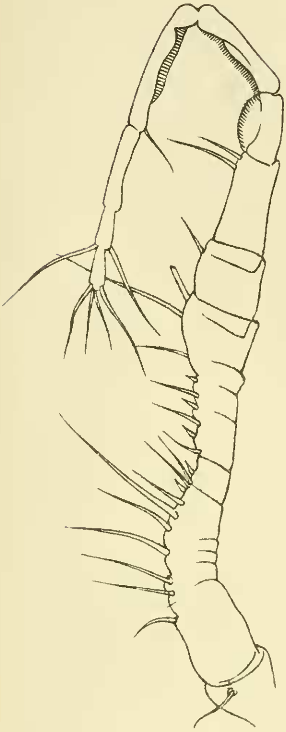

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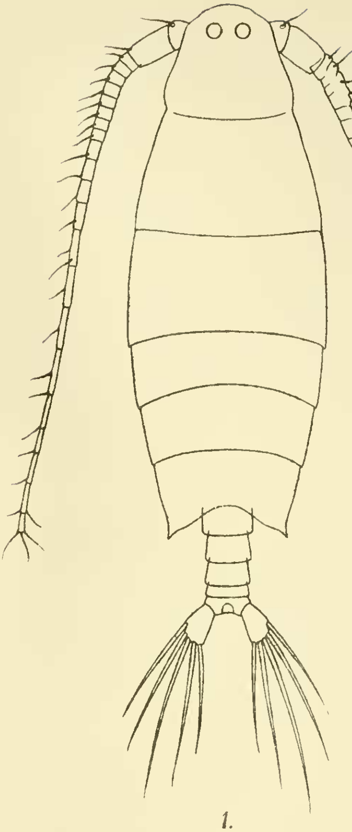

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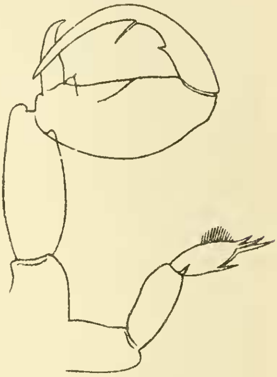

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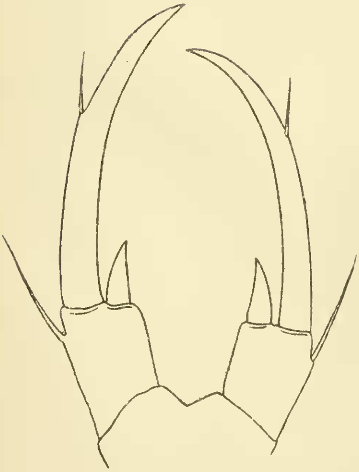

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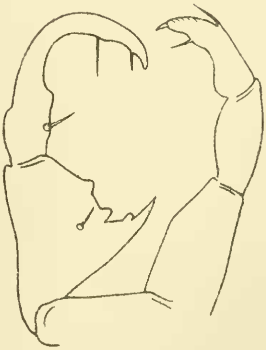

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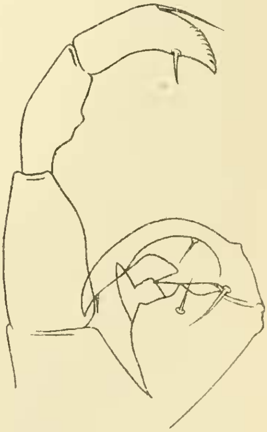

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the 53 specimens examined by me for this character have two, except one, in which they are fused on one side, and two which have three preoculars on one side.[a] The temporals are almost always 1 + 2, though one of our specimens (No. 7386*a*) has 2 + 2 on one side.[b] On the other hand, the postoculars vary between 3 and 4 and sometimes only 2; in our large series there are only three specimens which have 4 postoculars on both sides, and eight which have 4 on one side, but Hilgendorf[c] found 3 and 4 in about even proportion, viz, 23 with 3 and 28 with 4 on both sides, and 7 with 3 and 4 unsymmetrically (unless his statement involves some misprint, for instance, 8 instead of 28).

The coloration and markings, however, are very variable, especially the size and arrangement of the black spots and the amount of black on the underside. In the latter respect specimens vary without regard to locality between almost solid black and uniformly greenish white. The upper surface is often so dark that the dorsal blotches can be made out only with difficulty, but in most cases the orange-colored spots occupying the second, third, and fourth scale rows on each side are very conspicuous. The orange color is confined to the base and lateral margins of the scales, the median portion and tip being blackish, forming linear spots within the bright area.

The few Korean specimens examined by me have the dorsal blotches less differentiated and scarcely alternating with the lateral ones, thus forming more or less continuous crossbars and approaching what appears to be the common coloration of northern specimens of *Natrix lateralis*.

Habitat.—This species, as here restricted, is confined to Japan and southern Korea, being represented in the coast regions of the mainland by a closely allied form described hereafter.

The only definite locality of this species in Korea is Fusan, whence we have a specimen collected by Jouy. Two other specimens from Korea have also been examined by me, but their exact locality is uncertain, though probably either Fusan or Seoul.

The tiger snake seems to be common in Kiusiu and Hondo. Blomhoff, Siebold, and Buerger collected numerous specimens in the neighborhood of Nagasaki; von Martens obtained it for the Berlin Museum in Nagasaki, Yokohama, and Tokyo; British Museum has specimens from Kobe collected by the *Challenger* expedition and from

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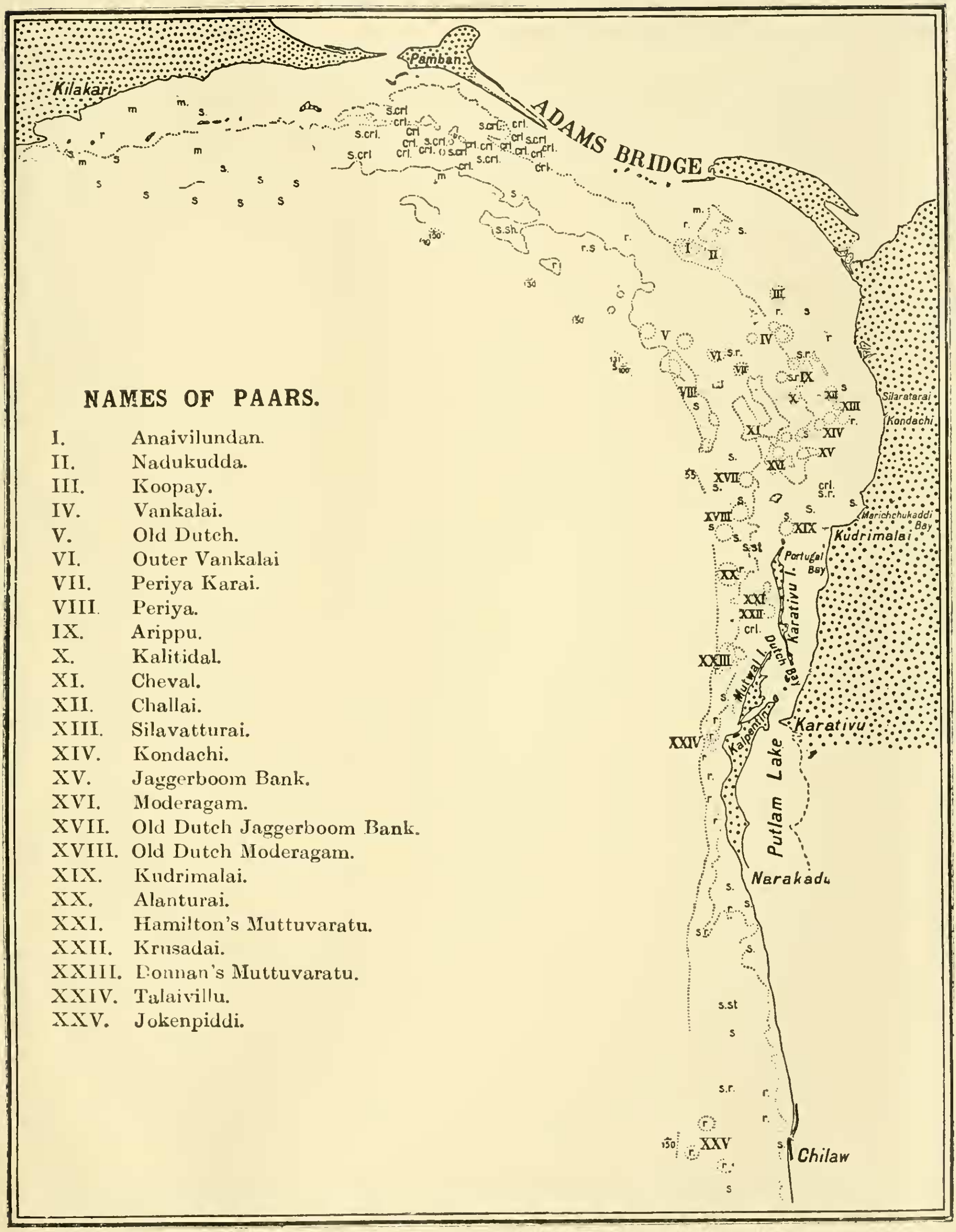
[a] One specimen (No. 33994) has the lower preocular on both sides fused with the loreal which thus enters the eye. Dr. Wall has examined three specimens with the loreal confluent with the postnasal on both sides, and one similarly abnormal on one side.

[b] No. 33999 has a small abnormal scale-like shield separated off from the upper anterior edge of the first temporal and not reaching the second.

[c] Sitz. Ber. Naturf. Fr. Berlin, 1880, p. 115.


Kilakari
Pamban
ADAMS BRIDGE
Silavaturai
Kondachi
Marichchukaddi Bay
Kudrimalai
Portugal Bay
Karativu I.
Dutch Bay
Mutwal I.
Kalpentin
Karativu
Putlam Lake
Narakadu
Chilaw

NAMES OF PAARS.

I.	Anaivilundan.
II.	Nadukudda.
III.	Koopay.
IV.	Vankalai.
V.	Old Dutch.
VI.	Outer Vankalai
VII.	Periya Karai.
VIII.	Periya.
IX.	Arippu.
X.	Kalitidal.
XI.	Cheval.
XII.	Challai.
XIII.	Silavatturai.
XIV.	Kondachi.
XV.	Jaggerboom Bank.
XVI.	Moderagam.
XVII.	Old Dutch Jaggerboom Bank.
XVIII.	Old Dutch Moderagam.
XIX.	Kudrimalai.
XX.	Alanturai.
XXI.	Hamilton's Muttuvaratu.
XXII.	Krusadai.
XXIII.	Donnan's Muttuvaratu.
XXIV.	Talaivillu.
XXV.	Jokenpiddi.

MAP OF THE GULF OF MANNAR.

List of specimens of Natrix tigrina.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Subcaudals.	Ventrals and subcaudals.	Oculars.	Temporals.	Supralabials.
U.S.N.M.	7385	Female [a]	Simoda, Japan		Doctor Morrow	19	162	73	235	2,3	1+2	7
Do.	7386 [a]	do	do	May —, 1855	W. Stimpson	19	166	74	240	2,3	1—2+2	7
Do.	7386 [b]	do	do	do	do	19	163	72	235	2,3	1+2	7
Do.	12711	do [b]	Yokohama, Japan	Apr. —, 1881	P. L. Jouy	19	161	69	230	2,3	1+2	7
Do.	12712	Halfgr	do	do	do	19	160			2,3	1+2	7
Do.	12713	Young	do	do	do	19	160	73	233	2,3	1+2	7
Do.	14147	Female	Japan			19	165	67	232	2,4	1+2	7
Do.	15420	Male	Oide, Shinshiu, Japan	Oct. —, 1882		19	156	72	228	2,3	1+2	7
Do.	31846	do [c]	Sendai, Satsuma, Kiusiu	June 4, 1903	H. M. Smith	19	161	83	244	2,3	1+1—2	7
Do.	31847	Halfgr	do	June —, 1903	do	19	169	75	244	2,3	1+2	7
Do.	31848	Female	Suzaki, Tosa, Shikoku	May 8, 1903	do	19	159	73	232	2,3	1+2	7
Do.	31849	Halfgr	do	do	do	19	157	79	236	1—2,3	1+2	7
Do.	31853	do	Kochi, Tosa, Shikoku	May 11, 1903	do	19	159	78	237	2,3	1+2	7
Do.	31854	do	do	do	do	19	158	85	243	2,3	1+2	7
Do.	31855	do	do	do	do	19	157	70	227	2,3	1+2	7
Do.	31856	Male	do	do	do	19	153			2,3	1+2	7
Do.	31857	do	do	do	do	19	157	72	229	2,3	1+2	7
Do.	31860	Female	do	May —, 1903	do	19	159	76	235	2,3—4	1+2	7
Do.	31861	do	do	do	do	19	168	80	248	2,2—3	1+2	7
Do.	31862	do	do	do	do	19	160	72	232	2,3	1+2	7
Do.	31863	do	do	do	do	19	160	70	230	2,3	1+2	7
Do.	31864	do	do	do	do	19	162	73	235	2,3	1+2	7
Do.	31865	Halfgr	do	do	do	19	158	69	227	2,3	1+2	7
Do.	31868	Male	do	do	do	19	162	75	237	2,3	1+2	7
Do.	31869	Female	do	do	do	19	166	74	240	2,3	1+2	7
Do.	31870	Young	do	do	do	19	157	82	239	2,3	1+2	7
Do.	31871	do	do	do	do	19	157	80	237	2,3	1+2	7
Do.	33982	Female	Mount Fuji, Hondo	July —, 1898	A. Owston	19	164	71	235	2,3	2+2	7
Do.	33983	Male	do	do	do	19	160	74	234	2,2—3	1+2	7
Do.	33984	Female	do	do	do	19	165	73	238	2,3	1+2	7

Do	33985	do	do	do	do	19	162	71	233	2,3—4	1+2	7
Do	33986	Male	do	do	do	19	162	80	242	2,3—4	1+1—2	7
Do	33987	Female	do	do	do	19	163	70	233	2,3—4	1+2	7
Do	33988	Male[d]	do	do	do	19	162	76	238	2,3	1+2	6—7
Do	33989	do	do	do	do	19	157	76	233	2,4	1+2	7
Do	33990	Young	do	do	do	19	156	72	228	2,3	1+2	7
Do	33991	Female	do	do	do	19	164			2,3	1+2	7
Do	33992	do	do	do	do	19	161			2,3	1+2	7
Do	33993	Male	do	do	do	19	155	74	229	2,3—4	1+2—3	6—7
Do	33994	Female[e]	do	do	do	19	168	71	239	2,3—4	1+2	7
Do	33995	Male	do	do	do	19	159	76	235	2—3,3	1+2	7
Do	33996	do	do	do	do	19	162			2,3—4	1+2	7
Do	33997	do	do	do	do	19	159	82	241	2,3	1+2	7
Do	33998	Female	do	do	do	19	168	69	237	2,3—4	1+2	7
Do	33999	do.[f]	Mori, near Yokohama	Oct. —, 1902	do	19	161	66	227	2,3	1+2	7
Do	34000	do	do	do	do	19	164	69	233	2—3,3	1+2	7
Do	34001	Male	Suruga, Hondo	Nov. —, 1903	do	19	160	68	228	2,3	1+2	7
Do	36541	Female	Tokyo, Hondo		Sei. Coll. Tokyo	19	162	70	232	2,4	1+2	7
Brit. Mus.	*a*	Male[g]	Japan			19	162	78	240			
Do	*b*	do.[g]	do			19	159					
Do	*c*	do.[g]	do			19	158	84	242			
Do	*d*	Female[g]	do			19	163	74	237			
Do	*e*	do.[g]	do			19	164	71	235			
Do	*f*	Male[g]	Kobe		Challenger Exped	19	160	76	236			
Do	*g*	Female[g]	do		do	19	163	80	243			
Do	*h*	do.[g]	do		do	19	166	72	238			
Do	*v*	do.[h]	Shimabara, Hizen, Kiusiu		P. A. Holst	19	161	71	232			
St. Petersb	1909	([i])	Japan		Leiden Mus	19	164	83	247	2,3		
Do	1910	([i])	do		do	19	164	71	235	2,3		
Do	1911	([i])	do		do	19	166			2,4		
U. S. N. M.	14611	Male	Korea		Dr. N. M. Ferebu	19	161	73	234	2,3	1+2	7
Do	17509	do	Fusan, Korea	1885	P. L. Jouy	19	163	67	230	2,3—4	1+2	7
Mich. Univ	30528		Korea		G. A. Olinger	19	165			2,2—3	1+2	7

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[a] Figs. 242–243. [b] P. 273. [c] Description p. 272. [d] Anal undivided. [e] Loreal fused with preocular. [f] P. 274. [g] Boulenger Cat. I, p. 250. [h] Boulenger, Cat. III, p. 607. [i] Strauch., p. 277.

NATRIX TIGRINA LATERALIS[a] (Berthold).

1858. *Tropidonotus tigrinus* GUENTHER, Cat. Colubr. Sn. Brit. Mus., p. 71 (part: Ningpo, China); Rept. Brit. India, 1864, p. 271 (part: northern China); Ann. Mus. Zool. St. Pétersbourg, I, 1896, p. 205 (Huihsien, prov. Kansu, China).—STRAUCH, Mém. Acad. St. Pétersbourg (7), XXI, no. 4, 1873, p. 176 (part: Strelok, Bay of Peter the Great, Amurland).—GIGLIOLI and SALVADORI, Proc. Zool. Soc. London, 1887, p. 594 (Olga Bay; Gensan).—BOULENGER, Ann. Mag. Nat. Hist. (6), V, Feb., 1890, p. 139 (Gensan, Korea); Cat. Snakes Brit. Mus., I, 1893, p. 249 (part: Gensan; Chefu; Peking; Ningpo; Kiukiang; Hainan); III, 1896, p. 607 (part: Chefu); Proc. Zool. Soc. London, 1899, p. 164 (Fokien).—BOETTGER, Ber. Senckenberg. Naturf. Ges., 1894, p. 139 (Lueshan Mts., Kiukiang, China); p. 146 (Delanshan, near Ningpo); p. 149 (Weihaiwei and Chefu); Kat. Schl. Mus. Senckenberg., 1898, p. 25 (part: northern China).—WALL, Proc. Zool. Soc. London, 1903, p. 86 (Yangtse Valley).—WERNER, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 354 (Hankow).—NIKOLSKI, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1, 1905, p. 222 (part: Hongkong; Possiet Bay; etc.).—*Amphiesma tigrinum* STONE, Proc. Phila. Acad., 1899, p. 184 (Peking; northern Pechili).

1859. *Tropidonotus lateralis* BERTHOLD, Nachrichten Ges. Wiss. Goettingen, 1859, p. 180 (type-locality, China; type in Goettingen Mus.).—JAN, Icon. Ophid., livr. 25, 1867, pl. v, fig. 1 (Bangkok, Siam).

1862. *Tropidonotus orientalis* GUENTHER, Proc. Zool. Soc. London, 1861, p. 391 (type-locality, Peking; types in Brit. Mus.; Swinhoe, collector); Ann. Mag. Nat. Hist. (3), IX, Jan., 1862, p. 59, pl. IX, fig. 3.—STRAUCH, in Przewalski's Mongoliya i Strana Tangutov, III, 1876, p. 48 (Ordos; Peking).

A glance at the list of specimens and their scale formulas under *N. tigrina* (p. 276) and the present form (p. 280) is sufficient to show that the latter is separable from the former by the lower number of scutes covering the underside of the body. There is not a very great difference in the number of ventrals (average 160.5 ventrals in 62 *N. tigrina*, and 155.6 in 20 *N. lateralis*) but the subcaudals are much more numerous in the Japanese form than in the Chinese. Thus in 54 specimens of the former they range between 66 and 85, while in 18 specimens of the latter between 53 and 64, thus leaving a perceptible gap between these two series. The sum of ventrals and subcaudals in doubtful cases will assist in identifying these specimens, for I find that in the above series the total number of scutes in *N. tigrina* varies between 227 and 248, and in *N. lateralis* between 206 and 224, the difference between the extremes in the former being 21 and in the latter 18. The average between these two series, 236.1 for *N. tigrina* and 215.2 for *N. lateralis*, therefore, is probably very nearly exact.

While there is thus a small gap in the formulas available, it can hardly be doubted that larger series would bridge it, and in view of the exceedingly close relationship of the two forms and their ranges unquestionably meeting in Korea, it is thought best to use a trinominal appellation for one of them. According to present usage and the various codes of nomenclature, the last-named form receives the trinominal; thus in this case the Chinese form becomes *Natrix tigrina lateralis*.

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[a] Signifying Lateral, referring to the spots on the sides.

In the above discussion I have made no reference to a specimen in the Imperial Museum, Ueno Park, Tokyo (No. 20), alleged to have been collected at Naha, Okinawa Shima. As already mentioned under *N. tigrina*, this locality is so unsupported by other evidence that one is justified in suspecting a mistake in labeling. This specimen, according to the count which I made while in Tokyo in 1895, has 163 ventrals and 64 subcaudals—showing the minimum in the above-mentioned series of Japanese specimens. It is otherwise identical with specimens of the tiger snake collected around Tokyo, and I have but little doubt that it is a Japanese specimen of *N. tigrina*, with a minimum number of scutes, if my count was really correct.

There is no specimen of this form in the United States National Museum, but as the chief difference from *N. tigrina* consists in the lower number of ventrals and subcaudals, as indicated above, a detailed description is not necessary. In all other respects the scale formula agrees with that of the Japanese form. The color appears to differ in the absence of alternation of the dorsal and lateral spots. Doctor Guenther describes the color of the types of his *Tropidonotus orientalis* as follows:

"Greenish olive, with three series of black spots anteriorly, becoming very indistinct on the middle of the trunk; a black subcrescentic spot on each side of the neck, without yellow; posterior margins of the upper labials and a spot on the temple black. Belly more or less blackish."

Habitat.—The mainland form of the tiger snake is distributed along the eastern coast of Asia from Olga Bay in the Russian Coast Province to Hainan and, if Jan's localities are correct, to Cochin China and Siam.[a] Boettger even seems to think that the specimen in British Museum credited to Hainan may have come from some other locality, or at least from the mountainous interior of that island. Possibly the Siamese origin also refers to specimens obtained in the mountains of the interior. It is not recorded from Formosa. Westward it has been found by Berezowski as far as southern Kansu, the province next to Thibet.

Both Mr. Leech and Doctor Giglioli obtained specimens in Gensan, northern Korea, and the Warshaw Museum has it from Strelok, a military post on the Bay of Peter the Great. Giglioli even obtained it as far north as Olga Bay, also the west side of the Sea of Japan. The types of Guenther's *T. orientalis* were collected by Swinhoe at Peking and the Philadelphia Academy has it from the same locality.

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[a] It may not be out of place to remark here that in Proc. Zool. Soc. London, 1899, p. 661, Mr. Stanley S. Flower gives a table of 21 specimens from Penang, Kedah, and Bangkok, which has the appearance of belonging to *Tropidonotus tigrinus*. This is due to a mistake in the typography, as the table, which is not self-explanatory, was apparently meant to follow the account of *Tropidonotus piscator*.

List of specimens of Natrix lateralis.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Subcaudals.	Ventrals + Subcaudals.
Goettingen		([a])	China			19	157	56	213
Brit. Mus	*k*	Male [b]	Peking, China		R. Swinhoe	19	153	63	216
Do	*l*	Young[b]	do		do	19	164	60	224
Do	*m*	Male	Chefu, China		do	19	150	64	214
Do	*n*	do	do		do	19	161	57	218
Do	*o*	do	do		do	19	154	65	219
Do	*p*	Female	do		do	19	157		
Do	*t*	Young	do			19	151	64	215
Do	*u*	Young[c]	do			19	153		
Do	*q*	Female[c]	Ningpo, China			19	160	55	215
Do	*r*	do.[d]	Kiukiang, China		A. E. Pratt	19	15		
Do	*s*	do.[d]	Hainan Island, China		J. Neumann	19	160	56	216
Senckenberg	7249 *c*	Halfg.[e]	Chefu, China		B. Schmacker	19	154	63	217
Do	7249 *c*	do.[e]	do		do	19	159	53	212
Do	7249 *d*	Adult[f]	Dalanshan, China		do	19	159	58	217
Do	7249 *i*	do.[e]	Weihaiwei, China		do	19	159	54	213
Do	7249 *k*	do.[g]	Lueshan Mts., China		do	19	151	55	206
Munich		Male [h]	Hankow, China		Doctor Haberer	19	150	63	213
St. Petersb		([i])	Ordos, China		Przewalski	19	147	63	210
Do		([i])	Peking, China		do	19	153	59	212
Brit. Mus	*i*	Male [d]	Gensan, Korea		J. H. Leech	19	159	63	222

[a] Type of *lateralis*.
[b] Type of *orientalis;* Boulenger, Cat. I, p. 250.
[c] Boulenger, Cat. III, p. 607.
[d] Boulenger, Cat. I, p. 250.
[e] Boettger, 1894, p. 149.
[f] Boettger, 1894 p. 146.
[g] Boettger, 1894 p. 139.
[h] Werner, p. 354.
[i] Strauch, p. 48.

NATRIX STOLATA[a] (Linnæus).

1758. *Coluber stolatus* LINNÆUS, Syst. Nat., 10 ed., I, p. 219 (type-locality "America; "type in Roy. Mus. Stockholm); 12 ed., I, 1766, p. 379 (Asia).—*Natrix stolatus* MERREM, Syst. Amph., 1820, p. 123.—STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 221 (Taipa, Formosa).—*Tropidonotus stolatus* BOIE, Isis, 1827, p. 535.—SWINHOE, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225 (Tamsui, Formosa).—GUENTHER, Rept. Brit. India, 1864, p. 266 (India to Formosa).—BOULENGER, Fauna Ind., Rept., 1890, p. 348, fig. (India to southern China); Cat. Snakes Brit Mus., I, 1893, p. 253 (India to China, Hainan, Formosa).—BOETTGER, Ber. Senckenberg. Naturf. Ges., 1894, p. 132 (Hainan).—WALL, Proc. Zool. Soc. London, 1903, p. 86 (Hongkong).—*Amphiesma stolatum* DUMÉRIL and BIBRON, Erpét. Gén., VII, Pt. 1, 1854, p. 727.

1801. *Elaps bilineatus* SCHNEIDER, Hist. Amph., II, p. 299 (type-locality, East Indies; type in Mus. Bloch).

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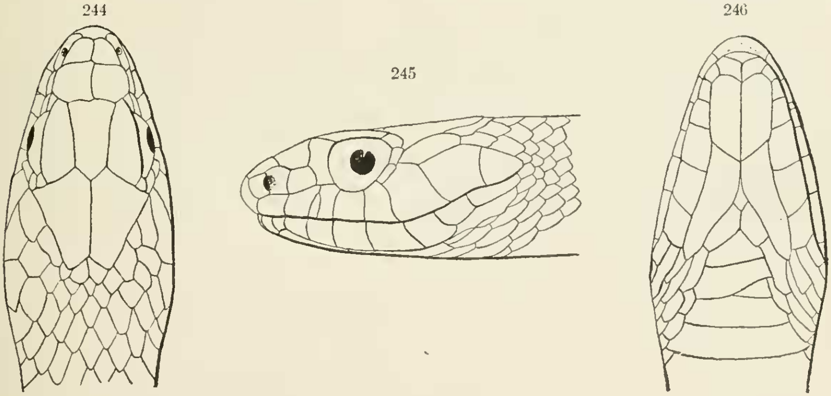
[a] Signifying wearing a stole, with reference to the two light-colored longitudinal bands

Description (figs. 244–246).—*Adult male:* U.S.N.M. No. 34036; Taipa, Formosa; March, 1903; A. Owston collection. Rostral much broader than high, well visible from above; internasals slightly shorter than the prefrontals, very narrow in front, their suture with rostral considerably shorter than suture between rostral and first labial; prefrontals in contact with supraoculars; frontal longer than its distance from tip of snout and interparietal suture; parietals equaling the distance of eye from tip of snout; nostril large, between two subequal nasals; loreal somewhat longer than high, upper edge shorter than and parallel with lower; one preocular, not in contact with frontal; 3 postoculars; temporals 1 + 2; supralabials 8, third, fourth, and fifth entering eye, sixth and seventh largest; 5 lower labials in contact with anterior chin-shields which are shorter than the posterior; 19 rows of scales, strongly keeled except outer row, and without apical pores; 149 ventrals; anal divided; 81 pairs of subcaudals. Color (in alcohol) above brownish gray with numerous narrow black crossbars alternating on each side of the median line anteriorly but continuous farther back; across this pattern two longitudinal, dorso-lateral pale bands occupying the whole of sixth scale row and the adjacent halves of fifth and seventh rows; posteriorly these bands are nearly uniformly pale, but anteriorly they exhibit a kind of chain pattern, inasmuch as the outer edges of the middle scale row are black except where the band intersects as black crossbar; below the lateral band many small irregularly alternating black spots; top of head with obscure dusky edges to the shields; no nuchal collar; supralabials whitish, the light color extending upward on the preocular and the lower postoculars, the vertical edges of the labials heavily margined with black as are also the preocular in front and the postoculars behind, the vertical, black edged, white bar in front of the eye being very characteristic; underside uniform whitish, each ventral with a black mark near the outer edge.



FIGS. 244–246.—NATRIX STOLATA. 2 × NAT. SIZE. 244, TOP OF HEAD; 245, SIDE OF HEAD; 246, UNDERSIDE OF HEAD. NO. 36510, U.S.N.M.

Dimensions.

	mm.
Total length	522
Snout to vent	382
Vent to tip of tail	140

This snake is not a large one, and a length of 700 mm. is probably seldom exceeded.

Variation.—Comparatively little variation is noted in the head shields of this species. The ninth supralabial noted in one of the Taipa specimens is merely a narrow wedge interpolated between the second and third supralabials, as shown in fig. 245. The range of ventrals and subcaudals is also restricted in the Formosan series, as shown in the table given below, but in specimens from all over the wide area inhabited by this species they vary between 120 and 161 and between 50 and 89, respectively. It seems, however, as if this wide range is more or less correlated with various geographical subdivisions.

Habitat.—From India to Philippine Islands and China. One of the most widely distributed species in southeastern Asia.

There are five species in the British Museum, collected by R. Swinhoe in Formosa, and I have recorded four specimens from Taipa, Formosa, collected by Mr. Tada. Our museum has since received three more from the same locality through Mr. Owston. In the Hamburg Museum there is also a specimen (No. 1563) collected by Doctor Warburg at Kelung, northern Formosa.

List of specimens of Natrix stolata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
U.S.N.M	34035	Male	Taipa, Formosa	Mar. —, 1903	A. Owston	19	148	2		1,3	1+2	8
Do	34036	do[a]	do	do	do	19	149	2	81	1,3	1+2	8
Do	34037	Female	do	do	do	19	149	2		1,3	1+2	8
Do	36510	do[b]	do	Sept., 1897	T. Tada	19	146	2	74	1,3	1+2	8-9
Sci. Coll. Tokyo	*b* 14	do	do	do	do	19	150	2	74	1,3	1+2	8
Do	*c* 14	Male	do	do	do	19	146	2	81	1,3	1+2	8
Do	*d* 14	Female	do	do	do	19	147	2	74	1,3-4	1+2	8
Hamburg	1563	Male	Kelung, Formosa		Doctor Warburg	19	142	2	77	1,3	1+2	8
Brit. Mus	π	do[c]	Formosa		R. Swinhoe	19	147	2	65			
Do	ρ	do[c]	do		do	19	147	2	75			
Do	σ	Female[c]	do		do	19	148	2	75			
Do	τ	do[c]	do		do	19	149	2	72			
Do	υ	do[c]	do		do	19	149	2	73			

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[a] Description, p. 281.

[b] Figs. 244–246.

[c] Boulenger Cat. I, p. 254.

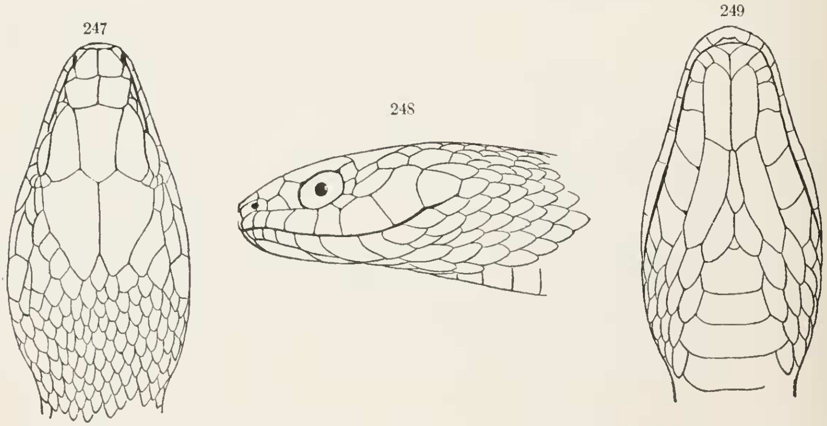
NATRIX PRYERI[a] (Boulenger).

GARASU HEBU (Okada).

Plate XX.

1887. *Tropidonotus pryeri* Boulenger, Proc. Zool. Soc. London, 1887, p. 149, pl. xviii, fig. 3[b] (type-locality "Loo Choo Islands;" types in Brit. Mus.).—Boulenger, Cat. Snakes Brit. Mus, I, (1893), p. 250 (Great Loo Choo I.).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 862; author's separate p. 13 (Nafa, Okinawa shima).—Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 107 (Okinawa shima; Miyakoshima group); Kat. Schlangen Mus. Senckenberg., (1898), p. 26 (Okinawa shima and Miyakoshima); Wall, Proc. Zool. Soc. London, 1903, p. 100 ("Nawa, Loo Choos"); 1905, II, p. 515 (Okinawa; Amami; Irimote).

Description.—*Adult female;* Science College Museum, Tokyo, No. 6; Iriomote shima, southern group, Riu Kiu Archipelago; Tashiro, collector (figs. 247–249). Rostral nearly twice as broad as high, just visible from above; internasals fully as long as prefrontals, rather truncate anteriorly, their suture with rostral equaling that of the latter with first supralabial; prefrontals in contact with supraoculars; frontal longer than its distance from tip of snout, wider in front than behind, wider than supraoculars; parietals longer than distance of eye from tip of snout; nostril between two subequal nasals; loreal longer than high; one preocular, not in contact with frontal; three postoculars (normal), four on right side; 2 + 1 temporals, the lower one of the second row on both sides abnormally



Figs. 247–249.—Natrix pryeri. 1⅓ × nat. size. 247, top of head; 248, side of head; 249, underside of head. No. 6, Sci. Coll. Tokyo.

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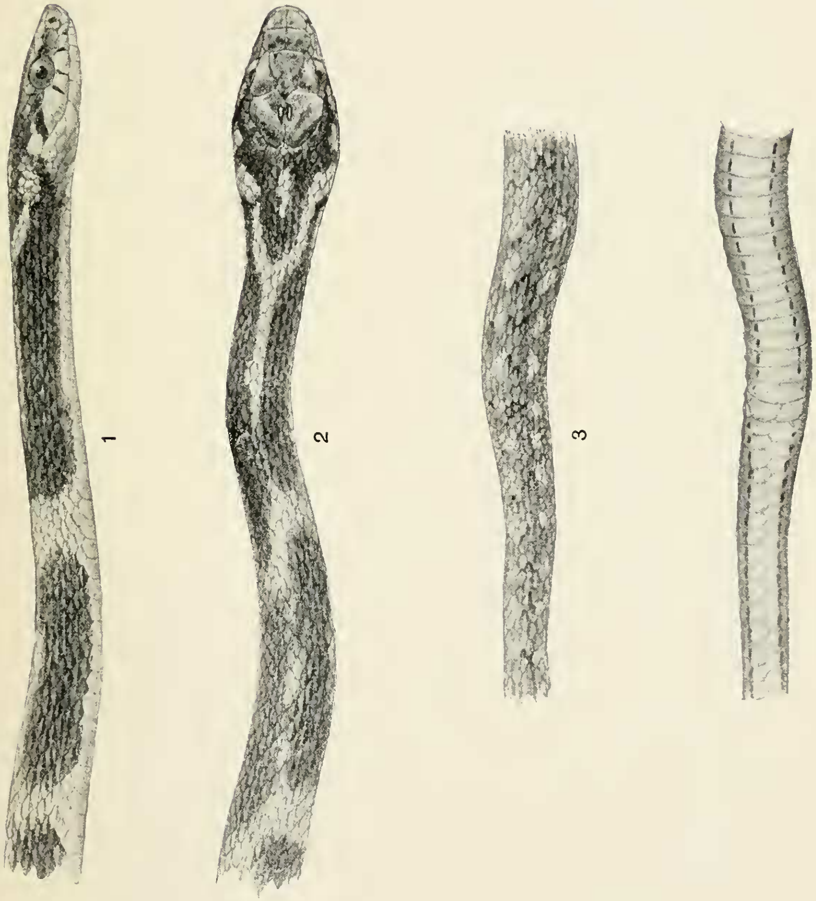
[a] For Henry James Stovin Pryer, a well-known naturalist and collector, who lived, as a merchant in Yokohama for many years. He was at one time connected with the Museum of the Educational Department Museum in Tokyo. Born in London, June 10, 1850; died in Yokohama, February 17, 1888.

[b] Reproduced in this work on Plate XX.



Natrix pryeri. (From Boulenger.)

For explanation of plate see page 555.

fused with seventh supralabial; eight supralabials, fourth and fifth entering eye, sixth and seventh largest; five lower labials in contact with anterior chin-shields which are shorter than the posterior; 19 rows of scales, with two apical pits, all keeled; 170 ventrals; anal divided; (tail broken). Color (in alcohol) pale clay-color, with long, dark, dorso-lateral, slightly alternating blotches anteriorly separated by whitish, black-edged, vertical bars on the sides, this pattern shortening up posteriorly and resolving itself into smaller dusky spots on the back and a series of whitish spots on the sides; supralabials whitish, the anterior five with black posterior margin; an oblique black line from the middle postocular, across lower portion of lower anterior temporal, sending a short branch downward along upper third of posterior edge of sixth supralabial, crossing the seventh labial nearly diagonally and the lower anterior corner of the eighth labial to the angle of the mouth; the lower, anterior and upper margins of the latter black, isolating a sharply-defined whitish spot; behind the angle of the mouth a round whitish black-edged spot continued backward and upward to the middle of the neck as a similarly edged but slightly narrower whitish band forming a crescent, or rather a chevron, on the nape; underside uniform pale, with a series of small dusky spots on each side near the outer angle of the ventrals and subcaudals.

Dimensions.

	mm.
Snout to vent	675
Tail defective.	

The tail in this species is nearly one-third the total length. A specimen in British Museum measuring 930 mm. has a tail 300 mm. long. A similar proportion would give a total length for the specimen described above of about 1 meter, probably near the maximum length of this species.

Variation.—Scale formula fairly constant. Temporals are said rarely to be 1 + 2; the specimen described above has 2 + 1 instead of 2 + 2; it has also four postoculars on one side instead of three, the normal number. Dr. Wall has recorded a specimen with two postoculars on one side. Ventrals range between 170 and 181 in thirteen specimens, and subcaudals between 114 and 128 in seven specimens.

Remarks.—The color pattern of head and nape of this species is an enlarged copy of that of *Natrix vibakari, craspedogaster,* and *khasiensis:* the black margin to the anterior supralabials; the oblique, black postocular band crossing the upper half of the penultimate labial and the lower margin of the last one, thereby separating it from the others; the dark upper edge to the last thus isolating a well circumscribed whitish spot on the latter; the subsequent postoral light spot and temporo-nuchal crescent edged with dusky; each one of these features is more or less plainly indicated in all these species. The median nuchal light streak described in *N. vibakari* is not visible in the specimen of *N. pryeri* before me, but it is very distinct in the figure accompanying the original description of the species [a] herewith reproduced (Plate XX, fig. 2); the lateral spots on the ventrals are common to all these species, though not by any means confined to them. The white dorso-lateral spots of the young of *N. vibakari* are very marked in *N. craspedogaster* and also on the posterior part of *N. pryeri*. The sudden increase in the size of the posterior maxillary teeth of the latter is no real obstacle, for as I have shown above (p. 264) *N. vibakari* may with propriety be said also to have suddenly enlarged posterior maxillaries. Moreover, *Natrix chrysarga*, which all authors agree in referring to the so-called "*Amphiesma*" group, appears also to belong to the assembly of species here discussed, in spite of the fact that the posterior labials are not quite typically marked, though judging from Jan's figure of his *Amphiesma platyceps*, the Himalayan specimens at least may come pretty close to the characteristic pattern.

Habitat.—This species has now been recorded from all the groups of the Riu Kiu chain. The types were from the "Loo Choos," without further locality, but both Holst and Fritze obtained it in Okinawa shima, from which island specimens also are in the National Museum in Tokyo (no. 8) and in Museum Senckenbergianum. The latter also has a specimen from Miyakoshima in the Saki shima group, both obtained through Mr. Schmacker. Finally, a specimen from Nishiomote shima, also called Iriomote shima, of the same group, is in the Science College Museum, Tokyo. Dr. Wall has recently recorded a specimen from the latter island and three from Amami-o-shima, of the northern group.

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[a] Proc. Zool. Soc. London, 1887, pl. XVIII, fig. 3.

List of specimens of Natrix pryeri.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected, or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
Sci. Coll. Tokyo	6	Female [a]	Iriomote shima, Riu Kiu.		Tashiro	19	170	2		1,3-4	2+1	8
Nat. Mus. Tokyo	8	Male	Okinawa shima, Riu Kiu.			19	178	2		1,3	2+2	8
Do		Female	do			19	178	2		1,3	2+2	8
Do		do	do			19	174	2	121	1,3	2+2	8
Brit. Mus	*a*	Male [b]	"Loo Choo"		H. J. S. Pryer	19	180	2	121	1,3		8
Do	*b*	do.[b]	do		do	19	181	2		1,3		8
Do	*c*	do.[b]	do		do	19	181	2	128	1,3		8
Do	*d*	Female [b]	do		do	19	176	2		1,3		8
Do	*e*	do.[c]	Great Loo Choo		P. A. Holst	19	177	2	114	1,3		8
Do	*f*	Young [c]	do		do	19	171	2	118	1,3		8
Senckenb	7250*a*	do.[d]	Okinawa		B. Schmacker	19	175	2				
Do	7250*b*	Adult [d]	Miyako shima		do	19	176	2	118			
Do		do.[d]	do		do	19	179	2	125			

[a] Description, p. 284, figs. 247-249.

[b] Boulenger, Cat. I, p. 251; types.

[c] Boulenger, Cat. I, p. 251.

[d] Boettger, 1895, p. 107.

NATRIX PISCATOR[a] (Schneider).

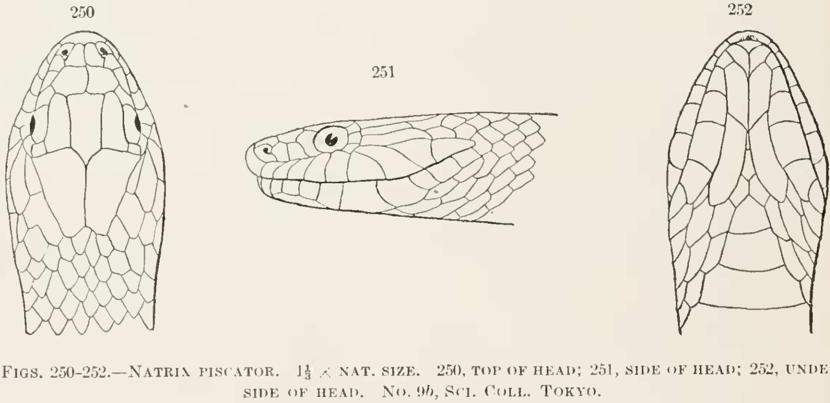
1799. *Hydrus piscator* Schneider, Hist. Amphib., I, p. 247 (type-locality, East Indies).—*Natrix piscator* Merrem, Syst. Amphib., 1820, p. 122.—Stejneger, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 221 (Taipa, Formosa).—*Tropidonotus piscator* Boie, Isis, 1827, p. 535.—Boulenger, Cat. Sn. Brit. Mus., I, 1893, p. 230 (India to southern China and Malay Archipelago); Proc. Zool. Soc. London, 1899, p. 163 (Kuatun, Prov. Fokien, China).—Boettger, Ber. Senckenberg. Naturf. Ges., 1894, p. 132 (Hainan); Kat. Schl. Mus. Senckenberg., 1898, p. 22 (India, China, and Japan).—Wall, Proc. Zool. Soc. London, 1903, p. 86 (Hongkong).

1837. *Tropidonotus quincunciatus* Schlegel, Phys. Serp., II, p. 307, pl. xii, figs. 4–5 (part; type-locality, Java).—Jan, Icon. Ophid., livr. 27, 1868, pl. i, figs. 1–2 (Bengal).—Boettger, Offenbach. Ver. Naturk. 24–25 Ber., 1885, p. 150. (China); 26–28 Ber., 1888 (p. 76).

1860. *Amphiesma flavipunctatum* Hallowell, Proc. Phila. Acad., 1860, p. 503 (type-locality, Canton River, China; type in Phila. Acad.; cotype U. S. Nat. Mus. No. 7387; Hongkong; Brooke, collector).

A large number of synonyms, many based on the various plates in Russell's "Indian Serpents," are here purposely omitted.

Description (figs. 250–252).—*Adult female;* U.S.N.M. No. 36511; Sci. Coll. Tokyo, No. 13; Taipa, Formosa; September, 1897; T. Tada, collector. Rostral much broader than high, visible from above; internasals much narrowed anteriorly, their sutures with the rostral scarcely more than one-half the suture of the latter with the first supralabial; prefrontals broadly in contact with supraoculars; frontal, with almost parallel sides, longer than its distance from tip of snout, and slightly longer than the interparietal suture; parietals longer than the distance of eye from tip of snout; nostril small, semilunar, in the upper posterior corner of the anterior nasal; loreal higher



Figs. 250-252.—Natrix piscator. 1⅓ × nat. size. 250, top of head; 251, side of head; 252, underside of head. No. 9*b*, Sci. Coll. Tokyo.

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[a] Signifying a fisherman. The masculine form is retained notwithstanding the fact that *Natrix* is of the feminine gender, in analogy with the usage of Linnæus himself in writing *Coluber natrix*, a usage followed by all subsequent writers (*Tropidonotus natrix*). A similar case is *Agkistrodon contortrix*.

than long, upper edge considerably shorter than lower; one preocular widely separated from frontal; eye rather small; three postoculars; 2+2 temporals, the upper one of the second row fusing with the one behind it so as to form a large irregular shield bordering the parietal laterally; 9 supralabials, fourth and fifth entering eye, seventh and eighth largest; five lower labials in contact with anterior pair of chinshields, which are much shorter than posterior; 19 rows of scales, without pores, rather feebly keeled, the two outer rows smooth; 140 ventrals; anal divided; 74 pairs of subcaudals. Color (in alcohol) pale tawny-olive, with numerous small black spots in four, alternating, longitudinal rows, the lower ones on the third and fourth scale rows largest and most distinct anteriorly; head nearly uniform above, with a pale black-edged oval spot on the posterior end of the interparietal suture and the scale immediately behind; a similar but smaller dot on each side of the interparietal suture near the frontal; sides of head pale, the anterior supralabials without black margins; a sharply defined narrow black line from the lower edge of the eye obliquely backward following the suture between sixth and seventh supralabials to the commissure; a similar line from the upper postocular parallel with the other across temporals and eight supralabials to the lip, which it crosses where the suture between eighth and ninth supralabials join the commissure; the broad band between these black lines lighter and somewhat yellower than the rest of the head; back of the angle of mouth a similarly colored crescentic nuchal band interruptedly outlined by black; lower side pale, ventrals and subcaudals narrowly margined with blackish.

Dimensions.

	mm.
Total length	673
Snout to vent	497
Vent to tip of tail	176

Specimens of this species measuring 1,200 mm. are on record.

The *young* (U.S.N.M. No. 34051) slightly more than 150 mm. long, is colored essentially as the adult described above, only the pattern is more definite, the spots larger, especially those on the sides which descend to the ventrals and join their blackish margins; there is also a median dorsal row of spots which has become obsolete in the adult, so that the back is regularly checkered; the contrast between the light color of the postocular band and the rest of the sides of the head is very marked.

Variation.—The six Formosan specimens examined by me show great constancy in the scale formula, as all have 19 scale rows, 9 supralabials, 2+2 temporals (one has 3+2 on one side), and one preocular. Four have 3 postoculars on both sides, one has 3 on one side and 4 on the other, and one has 4 on both sides; the ventrals vary between 139 and 144, the subcaudals between 72 and 77 pairs. Boulenger notes the occurrence of 2+3 temporals, rarely 1+2; ventrals, 125–150; and subcaudals, 70–90. I may add here that Hallowell's cotype of *Amphiesma flavipunctatum*, from Hongkong (U.S. N.M. No. 7387) has the following scale formula:

sc. 19; v. 126; a 2; c. 85; l. 9; t. 2+2; oc. 1–3.

Doctor Wall, also in Hongkong specimens, found 5 postoculars on one side in one, and four on both sides in another; one had 8 supralabials on both sides, fourth only touching the eye.

The range of variation in coloration is very considerable, viz, from nearly uniform dark with small white spots, due to the great size of the blackish spots, to nearly uniform pale drab without any black markings whatsoever. Two specimens from Formosa (No. 16 *a*, Sci. Coll. and No. 36512 U.S.N.M.) show the latter peculiarity and in every respect agree with the Himalayan specimens, which have been called *Tropidonotus sanctijohannis*.[a]

Habitat.—The known range of this species embraces the whole of southeastern Asia from India to the Malay peninsula and archipelago, as well as Hainan and southern China as far north as Fokien.

Its occurrence in Formosa was first discovered by Mr. Tada, who collected five specimens at Taipa in November, 1897, as previously recorded by me.

In the collection recently acquired by the U. S. National Museum from Mr. A. Owston, there is a very young *N. piscator* (U.S.N.M. No. 34051) the label of which indicated that it has been collected at Mount Fuji. Here is undoubtedly a mistake, and it appears quite certain that the specimen in question has become confused with the four specimens of *Takydromus tachydromoides* (U.S.N.M. Nos. 34179–34183) said to have come from northern Formosa. This suggestion is corroborated by the fact that the latter, although said to have been collected on June 23, 1903, look as if they had been preserved for a much longer period, while the *Natrix*, which is alleged to date from August, 1898, is quite fresh. I therefore conclude that the latter was collected in northern Formosa June 23, 1903. (See p. 243.)

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[a] Boulenger, Cat. Snakes Brit. Mus., I, p. 230, pl. xv, fig. 1.

List of specimens of Natrix piscator.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
U. S. N. M.	7387	Male [a]	Hongkong, China.	1854. May —	Mr. Brooke.	19	126	2	85	1,3	2+2	9
Do.	34051	Young	Northern Formosa.	1903. June 23	A. Owston	19	142	2	....	1,3-4	2-3+2	9
Do.	36511	Female [b]	Taipa, Formosa	1897. Sept. —	T. Tada	19	140	2	74	1,3	2+2	9
Do.	36512	do. [c]	do	do	do	19	139	2	....	1,3	2+2	9
Sci. Coll. Tokyo.	9*a*	Female	do	do	do	19	139	2	76	1,3	2+2	9
Do.	9*b*	do. [d]	do	do	do	19	144	2	77	1,3	2+2	9
Do.	16*a*	do	do	do	do	19	142	2	77	1,4	2+2	9

[a] Type of *A. flavipunctatum*. [b] Description p. 288. [c] Sci. Coll. Tokyo No. 16 *b*. [d] Figs. 250-252.

NATRIX ANNULARIS[a] (Hallowell).

1856. *Tropidonotus annularis* Hallowell, Proc. Phila. Acad., 1856, p. 151 (type-locality, Ningpo, China; type in Mus. Phila. Acad.; Doctor McCartee, coll.).—Swinhoe, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225 (Tamsui, Formosa).—Guenther, Rept. Brit. India, 1864, p. 261 (Ningpo; Chikiang; Formosa); Ann. Mag. Nat. Hist. (6), I, 1888 (p. 171) (Mts. N. of Kiukiang).—Boulenger, Cat. Snakes Brit. Mus., I, 1893, p. 233 (China, Formosa).—Boettger, Ber. Senckenberg. Naturf. Ges., 1894, p. 146 (Chinhai, near Ningpo).—Wall, Proc. Zool. Soc. London, 1903, p. 86 (Yangtse Valley).

1859. *Tropidonotus chinensis* Berthold, Nachrichten Ges. Wiss. Goettingen, 1859, p. 180 (type-locality, China; type in Goettingen Mus.).

A nearly related form has recently been described by Doctor Werner as *Natrix habereri*[b] from the Ningpo Mountains, near Shanghai. It has practically the same scale formula as *N. annularis* (viz, 163–164 ventrals and 53–65 pairs of subcaudals), but the three outer scale rows are said to be smooth and the eye larger; the keels on the scales are not so strong. Above plumbeous, below red; markings as in *N. annularis*. Boulenger regards them as identical.[c]

Description.—Adult male; U.S.N.M. No. 34044; northern Formosa, May 25, 1903; A. Owston, collector (figs. 253–255). Rostral much wider than high, just visible from above; internasals narrow, especially in front, their suture with the rostral being shorter than that of the latter with first supralabial; prefrontals broadly in contact with supraoculars; frontal shorter than its distance from tip of snout, scarcely equaling the interprefrontal suture, with nearly parallel sides; supraoculars narrow, scarcely more than half as wide as frontal; parietals much longer than distance of eye from tip of snout, as long as frontal and prefrontals together; nostril small, round behind the middle and near the upper edge of the nasal which is only divided into two unequal parts below the nostril; loreal nearly rectangular, slightly longer than high; one preocular, widely separated from frontal; eye small; three postoculars, the lower one almost horizontal; temporal 2 + 3, those of the first row very long and the upper especially very narrow; eight supralabials, fourth entering eye; five lower labials in contact with anterior pair of chin-shields, which are considerably shorter than posterior, chin-shields and labials studded with numerous small, rounded tubercles; 19 rows of scales, with two somewhat obscure apical pits, striated and strongly keeled, except outer row, which is feebly keeled; 163 ventrals; anal divided; 61 pairs of subcaudals. Color (in alcohol) on back dark grayish drab with ill-defined black reticulations or series of small ill-defined, alternating black spots; sides gradually much paler toward the ventrals, with numerous vertical black bars about two scales wide and two scales apart, the bars continued on the ventrals joining the corresponding ones of the other side as half-rings or alternating with them; scales included in black lateral bars with pale centers; shields on head obscurely outlined with dusky; labials whitish, with blackish sutures both on upper and lower lip, except on suture between fifth and sixth supralabials; an obscure, oblique blackish postocular streak; lower parts pale vinaceous-cinnamon, with black half-rings.

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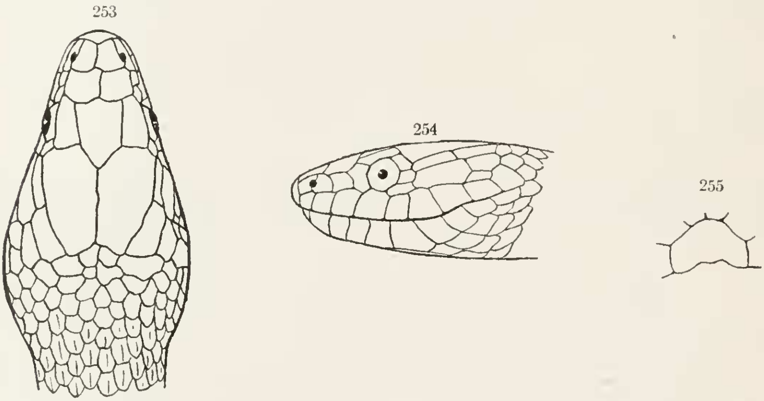
[a] Signifying with small rings, referring to ventral black half-rings.

[b] *Tropidonotus habereri* Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904. p. 354, pl. I, figs. 1–2 (type-locality Ningpo Mts., near Shanghai; types in Mus. Munich; Doctor Haberer, collector).

[c] Zool. Rec., 1903, Rept. p. 24.



FIGS. 253–255.—NATRIX ANNULARIS. 2 × NAT. SIZE. 253, TOP OF HEAD; 254, SIDE OF HEAD (3⅔ × NAT SIZE); 255, ROSTRAL FROM FRONT. NO. 34044, U.S.N.M.

Dimensions.

	mm.
Total length	517
Snout to vent	415
Vent to tip of tail	102

Boulenger records a specimen of this species measuring 820 mm. in total length.

The *young* (U.S.N.M. No. 34049; Formosa), total length 212 mm., tail 42 mm., is quite like the adult, only darker with more sharply defined pattern on sides and abdomen; four outer scale rows on each side as light as underside.

Variation.—The number of supralabials varies between 8 and 9, and the one entering the eye is the fourth or the fifth accordingly. Boulenger states that two supralabials rarely enter the eye. There is occasionally only a single anterior temporal. Ventrals vary between 145 and 163 (in twelve specimens), subcaudals between 53 and 69 pairs (in 8 specimens).

Habitat.—Restricted apparently to Formosa and southeastern China, where it has been found as far north as Ningpo and in the Yangtse Valley as far west as Kiukiang.

In Formosa it has been collected by Swinhoe, whose specimens are in British Museum. The United States National Museum also has two specimens from northern Formosa obtained recently from Mr. A. Owston.

List of specimens of Natrix annularis.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
				1903.								
U. S. N. M.	34044	Male[a]	Northern Formosa.	May 25	A. Owston	19	163	2	61	1,3	2 + 3	8
Do.	34049	Young	do	July 10	do	19	149	2	53	1,3	$\frac{2}{1}+3$	9
Brit. Mus.	*g*	Female[a]	Formosa		R. Swinhoe	19	147	2				
Do.	*h*	do.[b]	do		do	19	153	2	54			

[a] Description, p. 291, figs. 253–255.

[b] Boulenger, Cat. 1, p. 233.

NATRIX SWINHONIS[a] (Guenther).

1868. *Tropiaonotus swinhonis* GUENTHER, Ann. Mag. Nat. Hist. (4), I, 1868, p. 420, pl. XIX, fig. F[b] (type-locality, Formosa; type in Brit. Mus.; R. Swinhoe, collector).—BOULENGER, Cat. Snakes Brit. Mus., I, (1893), p. 218 (Formosa).

1888. *Tropidonotus swinhoei* BOETTGER, Offenbach. Ver. Naturk. 26–28 Ber., p. 137 (emendation).

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[a] For Robert Swinhoe, who collected the type; see p. 184.

[b] See this work, fig. 256.

Only the type specimen of this species being known, the description by Boulenger is here reproduced.

Description of type specimen.—*Adult female:* British Museum; Formosa; R. Swinhoe, collector (fig. 256). Head narrow and elongate; eye moderate; rostral broader than deep, just visible from above; internasals a little broader than long, shorter than the prefrontals; frontal once and a half as long as broad, as long as its distance from the end of the snout, shorter than the parietals; loreal as long as deep; one preocular and three postoculars; temporals 1+2; 6 supralabials, third and fourth entering eye, fifth very long; 4 lower labials in contact with the anterior chin-shields which are shorter than the posterior; scales strongly keeled, of outer row faintly keeled, in 15 rows; ventrals 150; anal divided; subcaudals *circa* 50. Brown above, anteriorly with irregular blackish spots; occiput and nape reddish, with a broad black collar; a black spot below the eye, and an oblique black band on the temporal region; lower parts yellowish, powdered with brown on the sides.

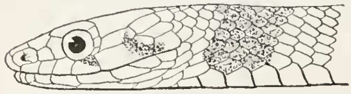

Fig. 256.—Natrix swinhonis. Enlarged. Side of head. Copy from Guenther, Ann. Mag. Nat. Hist., (4), I, 1868, pl. xix, fig. f.

Dimensions.

	mm.
Total length	580
Tail [defective] about	100

Habitat.—This species is described from Formosa. Only a single specimen is known, the type, collected by R. Swinhoe, being in the British Museum.

Remarks.—The nearest relative of this species appears to be *Natrix nuchalis* described in 1891[a] by Boulenger from specimens in the British Museum, collected by A. E. Pratt at Ichang, on the upper Yangtse. The scale formula is the same, but *N. nuchalis* has the scales very feebly keeled, a shorter head, and a very distinct groove along the middle of the back.

Genus ACHALINUS[b] Peters.

1869. *Achalinus* Peters, Mon. Ber. Berlin Akad. Wiss., 1869, p. 436 (type, *A. spinalis*).

1877. *Ophielaps* Sauvage, Bull. Soc. Philom. Paris (7), I, p. 108 (type, *O. braconnieri*).

The statement that this genus has no postoculars is scarcely quite correct. It is true that in some of the young specimens no such shield can be detected, but in our large specimen, No. 34046, there is plainly a small triangular, or rather semilunar, scute behind the eye fitting into the blunt angle between the anterior temporals. A similar scute is also discernible in the young specimen No. 34047.

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[a] Ann. Mag. Nat. Hist. (6), VII, p. 281.

[b] From ἄ, without; χαλῑνός, poison fang.

Thus far the genus has only been recorded from southern China and Japan. Its nearest relatives seem to be found in Ceylon and the Malay islands. However, specimens are as yet rare and it has been but recently discovered, so that it is not safe to draw any conclusions from its distribution and relationship as known at present.

Boulenger recognizes three species of this curious genus, viz, *A. rufescens*[a] and *A. braconnieri*[b], from southern China, and *A. spinalis*, from "Japan (?)." Of these, the first and the last were only known from one specimen each at the time the first volume of his catalogue was published (1893), while of *A. braconnieri* he had four specimens. *A. rufescens*, with its very long internasal suture and partly tricarinate scales[c] may be regarded as unquestionably distinct. Additional specimens from Japan, however, show so much deviation from the type of *A. spinalis* and so much variability in the direction of *A. braconnieri* that it may become difficult to maintain the latter as a distinct species. The characters which are supposed to distinguish the two species break down one by one. *A. braconnieri* was characterized as having 23 to 25 scale rows as against 21 in the type of *A. spinalis*, but five additional specimens from Japan seem to indicate that 23 is the normal number in the latter. Furthermore, in *A. braconnieri* the suture between the internasals is said to be shorter than that between the prefrontals, while in the type of *A. spinalis* these sutures are described as of equal length.[d] This is also approximately the case in our specimen from Kiusiu (U.S.N.M. No. 30731), but in the specimen in the Science College Museum, in Tokyo, also from Kiusiu, the interprefrontal suture is much longer, the one between the internasals being only 0.3 the length of the one between the prefrontals. In the two specimens from Mount Fuji (U.S.N.M. Nos. 34046–7) the relations are 0.4 and 0.6. Finally, *A. braconnieri* has two pairs of chin-shields, while the type of *A. spinalis* has three. But here, again, our specimen No. 30731 from Kiusiu steps in between as having only two, while the specimen in Tokyo and our two specimens from Fuji have three like the type.[a] The slight difference in the number of ventrals and subcaudals is completely bridged over by the additional specimens. The coloration, on the other hand, is the only feature which *thus far* offers a character by which to distinguish the two forms. *A. braconnieri* is described by Boulenger as being uniform blackish, the ventrals having a narrow whitish edge. The Japanese specimens all seem to have the median black dorsal line and often a blackish longitudinal median stripe on the underside of the tail, the latter being absent in No. 34047 and very obscure in No. 30731, which also shows trace of a dorso-lateral dusky line.

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[a] BOULENGER, Ann. Mag. Nat. Hist. (6), II, 1888, p. 43, (type-locality, Hongkong); Cat. Sn. Brit. Mus., I, 1893, p. 308, pl. xx, fig. 2; III, 1896, p. 612.

[b] *Ophiclaps braconnieri* SAUVAGE, Bull. Soc. Philom. Paris, (7), I, 1877, p. 109 (type-locality, eastern Kiangsi, China).—*Achalinus braconnieri* BOULENGER, Cat. Sn. Brit. Mus., I, 1893, p. 309; III, 1896, p. 613.

[c] The ventrals of the type are given as 136, subcaudals 82, and Boulenger (Cat. Snakes Brit. Mus., III, 1896, p. 612) in another male specimen from Hongkong counts 137 ventrals and 76 caudals. This is greatly at variance with the number of scutes given by Doctor Wall for four Hongkong specimens, namely, 150+56, 158+58, 158+61, and 154+58, respectively. In view of the apparent narrow limits of variation in this series as well as in *A. spinalis*, I am at a loss how to explain the above discrepancy.

[d] Peters says: "Die Praefrontalia sind nicht länger als die Internasalia." In the figure (fig. 1*a*), however, the prefrontal suture is considerably longer than the internasal suture. Which is correct?

It may be that an actual comparison of specimens from Japan and China may demonstrate further differences,[b] but it is quite clear that the Japanese species is very closely allied to the Ichang specimens collected by Mr. Pratt and described by Boulenger.

Recently Doctor Wall[c] has come to a similar conclusion as to the probable identity of the two species. He examined three Japanese specimens, which all had 23 scale rows, viz, the two specimens now in the U. S. National Museum alluded to above (Nos. 34046, 34047), and a third one from the same locality. Unfortunately he does not mention the coloration nor the number of chin-shields in the third specimen. It is also impossible to make out which of the scale formulas given belong to the the third Japanese specimen.[d]

Whether, on the other hand, the Ichang specimens are identical with Sauvage's originals of *A. braconnieri* from eastern Kiangsi is another question. His description is certainly very different from Boulenger's. Thus he speaks of the temporals as being numerous; of the prefrontals as small; his specimens have a small lower postocular, and the number of labials he states to be eight; the color, moreover, is a "brun ardoisé uniforme."

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[a] I may here call attention to the fact that in Boulenger's figure of *A. rufescens* (Cat. Sn. Brit. Mus., I, 1893, p. 308, pl. xx, fig. 2) there is only indicated two pairs of chin-shields, while the description speaks of three. This figure also shows only five supralabials as against six in the description.

[b] It may be well to point out a difference in the dental formula of the genus and the dentition as I find it in the specimen in the Science College specimen, Tokyo, and in our No. 34046. In these I count 14–16 maxillary teeth, which are subequal, the first three and the last three slightly smaller, while Boulenger for the genus says: "Maxillary teeth 22 to 25, small, equal." Is this character derived from Ichang specimens, and have we here a possible difference in the two forms?

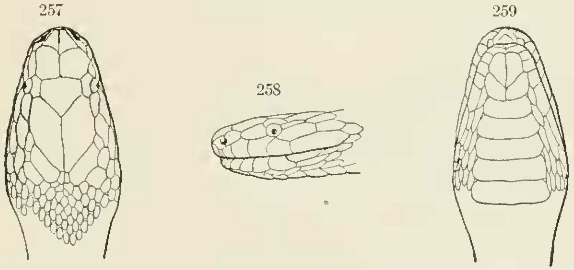
[c] Proc. Zool. Soc. London, 1903, p. 88.

[d] I presume that his scale formulas 165+44 and 165+48 are meant for our specimens No. 34047 and 34046, respectively. Repeated counts of these specimens give 163+45 and 165+49.

ACHALINUS SPINALIS[a] Peters.

1869. *Achalinus spinalis* Peters, Mon. Ber. Berlin Akad. Wiss., 1869, p. 436, pl. —, fig. 1 (type-locality unknown).—Boulenger, Cat. Sn. Brit. Mus., I, p. 309 (Japan?).—Namiye, Annot. Zool. Japon., II, Pt. 1, 1898, p. 29, fig. (Kiusiu).—Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 33 (Hakone Mts.).—Wall, Proc. Zool. Soc. London, 1903, pp. 88, 100 (Mt. Fuji).

Description (figs. 257–259).—*Adult female;* U.S.N.M. No. 34046; Mount Fuji, Hondo; August, 1898; A. Owston, collector. Rostral scarcely visible from above, wider than high, and so much hollowed out below that the surface laterally is represented as a ridge only; internasals very small, narrow anteriorly, the suture with rostral less than half that of the latter with anterior nasal; prefrontals very large, the suture between them twice as long as the one between the internasals, broadly in contact with supraoculars, and with second supralabial; frontal pentagonal, straight anteriorly, posterior angle acute, as wide as long, shorter than distance from tip of snout, scarcely one-half as long as parietals; supraoculars very small, their width less than one-fourth that of the frontal; parietals exceedingly large, twice as long as distance of eye from tip of snout, pointed posteriorly; nostril large, horizontally oval in the anterior of two nostrils which are deeply hollowed out; loreal longer than high, entering eye and in contact with prefrontal and supraocular but not with posterior nasal; no preocular; eye very small, smaller than loreal; a crescentic trace of a postocular in angle between two anterior temporals; 2+2 temporals, upper anterior smaller than the others, in contact with supraocular; a large, elongate shield bordering the posterior half of the parietals; six supralabials, first exceedingly small, sixth exceedingly large, as large as the other five together, fourth and fifth entering eye; mental deeply hollowed out, the surface forming a V-shaped ridge; 3 lower labials in contact with anterior chin-shields, which together



Figs. 257–259.—Achalinus spinalis. 2½ × nat. size. 257, top of head; 258, side of head; 259, underside of head. No. 30731, U.S.N.M.

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[a] Pertaining to the spine or backbone, referring to the black line along the middle of the back.

form a heart-shaped figure; 3 pairs of chin-shields, posterior shortest; 23 rows of small, nonimbricate, convex and keeled scales without apical pits, the soft skin mostly visible between the scales; 165 ventrals; anal entire; 49 undivided subcaudals. Color (in alcohol) above uniform "walnut-brown," more rufous toward the middle of back, with a very distinct black longitudinal stripe along the median line involving the median scale row and the adjacent half of the scale on either side; underside paler, more cinnamon colored, each scute with a narrow light edge and a darker submarginal line; a median dusky stripe on the underside of the tail.

Dimensions.

	mm.
Total length	412
Snout to vent	347
Vent to tip of tail	65

The *male* seems to have a relatively longer tail with more subcaudals. Thus the specimen in the Science College Museum, Tokyo, measures 410 mm. in total length, of which the tail is 90 mm. and contains 61 subcaudals.

The *young* is darker above in stronger contrast to the underside and seems to lack the dark median stripe on the underside of the tail.

Variation.—Only a few specimens are in the museums, but these show considerable variability. The six of which the individual scale formulas are recorded, agree in having 6 supralabials; no preoculars and no postoculars (except occasionally a trace); 2 + 2 elongated temporals; the scale rows vary between 21 and 23, six being known with 23 and only one, the type, with 21; ventrals between 146 and 166; subcaudals between 45 and 62; all have an undivided anal and undivided subcaudals. The specimen described above seems to be unusual in having the loreal separated from the posterior nasal by the prefrontal touching the second supralabial. The specimen figured (fig. 259) is also abnormal in possessing only two pairs of chin-shields. The Tokyo museum specimen shows a curious and rare anomaly in having the frontal divided longitudinally by a suture, and it is interesting to note that one of Sauvage's types of his *A. braconnieri*, from China, also has the frontal divided (though he does not say whether longitudinally or transversely); this specimen also has one of the supraoculars divided.

Habitat.—Under the supposition that *A. braconnieri*, which is recorded from eastern Kiangsi and from Ichang, in southern China, represents a distinct form, the present species is restricted to Japan.

Thus far only ten specimens are known, seven of which are from definite localities, which throw some light on the distribution of the species. Of these three are from Kiusiu, viz, the two which Mr. N. Takachiho collected at Hikosan, province of Buzen, near the northern extremity of the island, and a fine specimen sent our museum by Rev. Cyrus A. Clark from Miyazaki, toward the southern end of the same island. The one in Museum Senckenbergianum in Frankfort on the Main, which was obtained from Mr. B. Schmacker in 1889 came from the Hakone Mountains in Hondo, and Doctor Wall mentions three specimens in Owston's collection from "Mount Fuji." Two of the latter are now in the United States National Museum (Nos. 34046, 34047).

List of specimens of Achalinus spinalis.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.	Chin-shields.
U.S.N.M.	30731	Young[a]	Miyazaki, Hiuga, Kiusiu.		C. A. Clark	23	146	1	57	0,0	2+2	6	2
Do.	34046	Female[b]	Mount Fuji, Hondo.	1898. Aug. —	A. Owston	23	165	1	49	0,0	2+2	6	3
Do.	34047	Young	do	do	do	23	163	1	45	0,0	2+2	6	3
Berlin		([c])	Japan?			21	149	1	62	0,0	2+2	6	3
Sci. Coll. Tokyo.		Male[d]	Hikosan, Buzen, Kiusiu.	1895. June —	N. Takachiho.	23	163	1	61	0,0	2+2	6	3
Takachiho.		([e])	do		do	23	166		51				
Owston.		([f])	Mount Fuji, Hondo.			23							

[a] Figs. 257–259.

[b] Description, p. 297.

[c] Type; Peters, p. 436.

[d] Frontal divided.

[e] Namiye, p. 29.

[f] Wall, p. 88.

Subfamily HOMALOPSINÆ.

The snakes of this group are apparently closely allied to the Natricine snakes, differing chiefly in the presence of grooved fangs at the posterior end of the maxillary. They are even more thoroughly aquatic, having the nostrils on the upper surface of the snout and provided with valves by means of which they can be closed. The head is usually small and thick, scarcely distinct from neck, and the eyes are small mostly with a vertically elliptic pupil; very often there is only a single internasal shield.

The Homalopsine snakes are confined to southeastern Asia, including India, the Malay Archipelago, Philippines and southern China, New Guinea, and northern Australia. Two genera occur within our limits, inasmuch as two species of the genus *Enhydris* and one of *Hurria* have been recorded from Formosa.

The two genera may be distinguished as follows:

a^1 scales smooth	1. *Enhydris*, p. 300.
a^2 scales keeled	2. *Hurria*, p. 304.

Genus ENHYDRIS[a] Latreille.

1802. *Enhydris* Latreille, Hist. Nat. Rept., IV, p. 200 (type, *E. cærulea*=*Hydrus enhydris* Schneider) (not of Merrem 1820).

1830. *Hypsirhina* Wagler, Syst. Amphib., p. 169 (type, *H. aer*).

1842. *Ferania* Gray, Zool. Miscell., p. 67 (type, *H. sieboldii*).

1843. *Hypsiscopus* Fitzinger, Syst. Rept., p. 25 (type, *H. plumbea*).

1843. *Pythomorphus* Fitzinger, Syst. Rept., p. 25 (type, *H. sieboldii*).

1853. *Eurostus* Duméril, Prodrom. Class. Ophid., p. 102 (type, *E. dussumierii*).

1853. *Trigonurus* Duméril, Prodrom. Class. Ophid., p. 103 (type, *H. sieboldii*).

The authors who employ the generic name, "*Enhydris*, Merrem, 1820," for two of the Hydrid snakes which should correctly stand as *Lapemis*, seem to have overlooked entirely the fact that Latreille, as early as 1802, established the genus *Enhydris* for an entirely different set of snakes, embracing all Schneider's species of *Hydrus*, from *H. caspius* on. This name, which can not be discarded, as it is not a synonym of any name previously given, must have for type one of the six species enumerated by Latreille, and as neither he nor any of his successors have designated a type for the name, we are obliged to resort to the method of elimination. The last species mentioned by Latreille, *Enhydris dorsalis*, is of dubious application. The third, *Enhydris rynchops*, is the type of Daudin's *Hurria* (1803), Goldfusz' *Strephon* (1820), and Cuvier's *Cerberus* (1829), while three other species, viz, *E. caspius*, *piscator*, and *palustris* belong to the genus *Natrix* (*Tropidonotus*). A single species is thus left as type, viz, *Enhydris cærulea*, which is Schneider's *Hydrus enhydris*. This species, or rather a synonym of this species, was afterwards (1830) made the type of *Hypsirhina*, and there can be no doubt but that the latter name will have to give way to *Enhydris* Latreille. The same result is obtained by those who would fix the type by employing the "principle of tautonymy."

Two species have been recorded as occurring in Formosa and for that reason are here included. They may be distinguished as follows:

a^1 Scales in 19 rows; supralabials 8; ventrals less than 150........*E. plumbea*, p. 300.

a^2 Scales in 21 rows; supralabials 7; ventrals more than 150......*E. bennettii*, p. 302.

ENHYDRIS PLUMBEA[b] (Boie).

1827. *Homalopsis plumbea* Boie, Isis, 1827, p. 550 (type-locality, Java).—*Hypsirhina plumbea* Gray, Zool. Misc., 1842, p. 66.—Guenther, Rept. Brit. India, 1864, p. 280 (Java to Formosa).—Jan, Icon. Ophid., livr. 30, 1868, pl. v, figs. 2–3 (Java).—Boettger, Offenbach. Ver. Naturk. 24–25 Ber., 1885, pp. 123, 151 (China); Ber. Senckenberg. Naturf. Ges., 1894, p. 134 (Hainan).—Boulenger, Cat. Snakes Brit. Mus., III, 1896, p. 5 (Formosa; China; Siam; Malay Peninsula; Java).—Wall, Proc. Zool.

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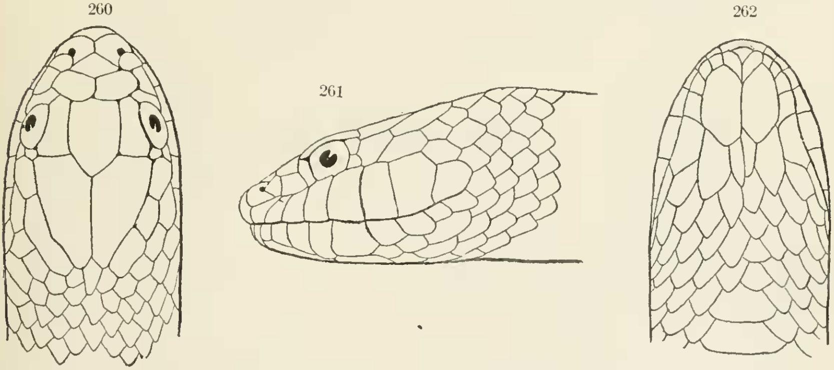
[a] From ἔνυδρὶς, a water snake.

[b] Signifying lead-colored.

Soc. London, 1903, p. 94 (Hongkong).—*Enhydris plumbea* STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 222 (Taipa, Formosa).

1834. *Hypsirhina hardwickii* GRAY, Ill. Ind. Zool., II (pl. LXXXVII, fig. 1) (type-locality, Pinang; type in Brit. Mus.).

Description.—Adult female; Science College Museum, Tokyo, No. 11*a*; Taipa, Formosa; November, 1897; T. Tada, collector (figs. 260–262). Rostral much broader than high, just visible from above; internasal single, twice as wide as long, separated widely from rostral by nasals, separated from loreal; prefrontals broader than long, broadly in contact with supraocular; frontal longer than its distance from tip of snout, equaling interparietal suture, nearly straight anteriorly, sides parallel, twice as wide as supraocular at center of eye; parietals as long as their distance from rostral, rather narrow posteriorly; nostrils small, round, on upper surface of snout, in the posterior margin of the anterior nostrils which are broadly in contact behind the rostral; posterior nasal less than half the size of the anterior, smaller than loreal, which is slightly longer than high; eye small, its diameter less than its distance from edge of lip; one preocular, not in contact with frontal; two postoculars; temporals 1+2; 8 supralabials, increasing in height backward to the seventh, which is largest, and much higher than eight, first in contact with loreal, separating posterior nasal from second supralabial, fourth and fifth entering eye; five lower labials in contact with anterior chin-shields; posterior chin-shields slightly shorter than anterior, separated from each other by two scales; 19 rows of smooth scales without apical pits; 130 ventrals; anal divided; 31 pairs of subcaudals. Color (in alcohol) above uniform slate gray; labials and two outer scale rows whitish with gray edges; underside whitish, each scute with lateral edge and base narrowly margined with dark gray and with a median basal spot of the same color; on anal shield and the underside of the tail a sharply defined median line of dark gray.



FIGS. 260–262.—ENHYDRIS PLUMBEA. 2 × NAT. SIZE. 260, TOP OF HEAD; 261, SIDE OF HEAD; 262, UNDERSIDE OF HEAD. NO. 11*a*, SCI. COLL. TOKYO.

Dimensions.

	mm.
Total length	430
Snout to vent	382
Vent to tip of tail	48

Variation.—Few deviations from the specimens described above are recorded. In the other specimen from the same locality the posterior nasal is in contact with second supralabial. Sometimes only the fourth supralabial enters the eye. The number of ventrals varies between 120 and 134, subcaudals between 29 and 46. Coloration is also rather constant; a median dorsal series of small black spots may be present and the whole underside may be unspotted.

Habitat.—Originally described from the Malay Archipelago this species has since been found on the opposite mainland from Burma to southern China. It occurs in Formosa, there being two specimens in British Museum collected by R. Swinhoe, and two specimens were collected by Tsunasuke Tada in 1897 at Taipa.

List of specimens of Enhydris plumbea.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals	Supralabials.
U.S.N.M.	36513	Male[a]	Taipa, Formosa	1897. Nov. —,	T. Tada	19	126	2	....	1,2	1+2	8
Sci. Coll. Tokyo	11*a*	Female[b]	do	do	do	19	130	2	31	1,2	1+2	8
Brit. Mus.	(a)	Male[c]	Formosa		R. Swinhoe	19	128	2	40	....	....	....
Do	(b)	Female[c]	do		do	19	129	2	33	....	....	....

[a] Sci. Coll. Tokyo, no. 11*b*.
[b] Description, p. 301; figs. 260–262.
[c] Boulenger, Cat., III, p. 5.

ENHYDRIS BENNETTII[a] (Gray).

1842. *Hypsirhina bennettii* GRAY, Zool. Miscell., p. 67 (type-locality, China; type in Brit. Mus.; Bennett, collector).—GUENTHER, Rept. Brit. India, 1864, p. 283 (China).—W. L. SCLATER, List Sn. Ind. Mus., 1891, p. 55 (Formosa).

1885. *Hypsirhina bennetti* BOETTGER, Offenbach. Ver. Naturk. 24 and 25 Ber., p. 151 (China); Ber. Senckenberg. Naturf. Ges., 1894, p. 134 (Hainan); Kat. Schl. Mus. Senckenberg., 1898, p. 88 (Hainan; Herz, collector).—BOULENGER, Cat. Sn. Brit. Mus., III, 1896, p. 8 (China).

1854. *Hypsirhina maculata* DUMÉRIL and BIBRON, Erpét. Gén., VII, Pt. 2, p. 950 (type-locality, China; type in Paris Mus.; Eydoux, collector).

1868. *Hypsirhina enhydris* var. *maculata* JAN, Icon. Ophid., livr. 30, pl. IV, fig. 1.

No specimen from Formosa being accessible to me, I describe one which probably hails from the mainland opposite.

Description.—*Male;* U.S.N.M. No. 22128; Hongkong, China?; Dale and Jouy, collectors (figs. 263–265). Rostral somewhat broader than high, visible from above; internasal single, widely separated from rostral by nasals, small, not much broader than long, widely separated from loreal; prefrontals smaller than nasals, in contact with them and with supraoculars; frontal somewhat shorter than its distance from tip of snout, nearly twice as wide as supraoculars at center of eye; parietals rather broad, the lateral outline irregular and showing evidence of fusion with adjacent scales; nostrils semilunar, on top of snout, in a large nasal which on the left side is semidivided by a suture from nostril to first labial; nasals broadly in contact with each other behind rostral with prefrontals and first supralabials; loreal trapezoid, longer than high, in contact with first three supralabials; one preocular, not in contact with frontal; eye small, its diameter less than distance from edge of lip; two postoculars; 1+2 temporals; 8 supralabials, increasing in height backward to the sixth, which is highest, first in contact with loreal, thus excluding nasal from second, fourth entering eye; three lower labials in contact with anterior chin-shields, which are followed by two pairs of smaller chinshields, both separated by scales; 21 rows of smooth scales without pits; 164 ventrals; anal divided; 64 subcaudals. Color (in alcohol) above drab gray, with two series of irregular dark brownish gray dorsal spots, which anteriorly unite into short crossbars and on the neck to a median longitudinal dark band; outer four scale rows white, the first and fourth having their lower and upper edge respectively margined with dark gray, forming an upper and lower dark indented edge to the lateral white band; labials and whole underside whitish, each scale and scute edged with dark gray, the ventrals with a median series of dark spots formed by a projection of the dark basal edge, and a similar arrangement on the subcaudals, causing a zigzag longitudinal dark band on the median line of the underside of the tail.

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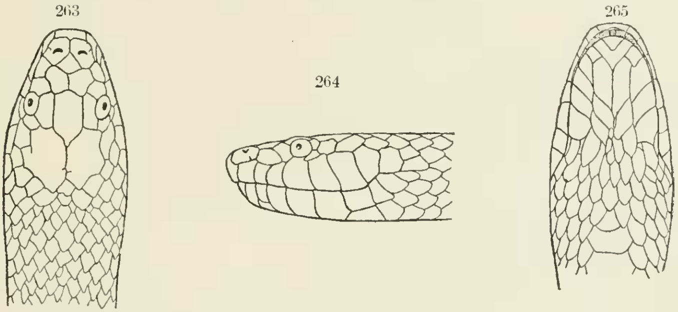
[a] Named after G. Bennett, esq., who collected the type.



Figs. 263-265.—Enhydris bennettii. 2 × nat. size. 263, top of head; 264, side of head; 265, underside of head. No. 22128, U.S.N.M.

Dimensions.

	mm.
Total length	377
Snout to vent	314
Vent to tip of tail	63

Variation.—In the few specimens of this species recorded the number of ventrals varies between 158 and 164, subcaudals between 47 and 54.

Habitat.—Apparently restricted to China. The authority for the the occurrence of this species in Formosa is a specimen in the Indian Museum (No. 12693) recorded by Mr. W. L. Sclater (*l. c.*). It was received from the Hongkong Museum in exchange.

List of specimens of Enhydris bennettii.

U. S. N.M. No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
22128	Male [a]	Hongkong ?		Dale and Jouy	21	164	2	54	1,2	1+2	8

[a] Description, p. 302; figs. 263–265.

Genus HURRIA [a] Daudin.

1803. *Hurria* Daudin, Bull. Soc. Philom. Paris, III, no. 72, March, 1803, p. 187 (type, *Hydrus rynchops*).
1813. *Huria* Fischer, Zoognosia, 3 ed., I, p. 65 (emendation).
1815. *Hurrianus* Rafinesque, Anal. Nat., p. 77 (emendation).
1820. *Strephon* Goldfusz, Handb. Zool., II, p. 151 (substitute for *Hurria*).
1829. *Cerberus* Cuvier, Régne Anim., 2 ed., II, p. 81 (type, *Coluber cerberus*).
1839. *Cerebus* Swainson, Classif. Fish. Amph. Rept., II (Lardner's Cab. Encycl.), p. 366 (*lapsus*).

The name *Cerberus*, by which this genus is generally known, must give way to *Hurria* of Daudin, 1803, the exclusive type of which is Russell's, Indian Serpents, pl. XL, which Doctor Boulenger identifies as *H. rynchops*.

HURRIA RYNCHOPS [b] (Schneider).

1799. *Hydrus rynchops* Schneider, Hist. Amphib., I, p. 246 (based on Russell, Ind. Serp., I, pl. XVII; type-locality, Ganjam).
1801. *Elaps boaeformis* Schneider, Hist. Amphib., II, p. 301 (type-locality not given; type in Mus. Univers. Halle).
1802. *Hydrus cinereus* Shaw, Gen. Zool., III, Pt. 2, p. 567 (based on Russell, pl. XVII).
1803. *Hurria schneideriana* Daudin, Hist. Nat. Rept., V, p. 281 (substitute name for *Elaps boaeformis* Schneider).
1803. *Hurria bilineata* Daudin, Hist. Nat. Rept., V, p. 284 (based on Russell, Ind. Serp., II, pl. XL; type-locality, Hyderabad).

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[a] From the Indian name Hurriah, by which Russell designated the snake which Daudin named *Hurria bilineata*.

[b] From *Rynchops*, better *rhynchops*, from ῥύγχος, snout, and ὤψ, eye, or face.

1803. *Coluber cerberus* DAUDIN, Hist. Nat. Rept., VII, p. 167 (based on Russell, pl. XVII).
1820. *Python elapiformis* MERREM, Tent. Syst. Amph., p. 89 (substitute for *Elaps boaeformis* Schneider).
1820. *Python rhynchops* MERREM, Tent. Syst. Amph., p. 90 (emendation).—*Cerberus rhynchops* GUENTHER, Rept. Brit. India, 1864, p. 279 (East Ind. archipelago, Ceylon, India, Malay peninsula, Siam).—BOULENGER, Cat. Snakes Brit. Mus., III, 1896, p. 16 (India, Malay peninsula and archipelago, Philippines, Pelew Islands).
1826. *Homalopsis molurus* BOIE, Isis, 1826, p. 213 (type-locality, Moluccas).
1837. *Homalopsis schneideri* SCHLEGEL, Phys. Serp., I., p. 171 (Pondichery, Bengal, Java, Timor, Amboina, New Guinea); II, p. 341 (*schneiderii*).
1837. *Coluber obtusatus* REINWARDT, in Schlegel, Phys. Serp., II, p. 341.
1837. *Cerberus russelii* CUVIER, in Schlegel, Phys. Serp., II, p. 342, footnote (Pondichery).
1849. *Cerberus acutus* GRAY, Cat. Snakes Brit. Mus., p. 65 (type-locality, Borneo; type in Brit. Mus.).
1849. *Cerberus unicolor* GRAY, Cat. Snakes Brit. Mus., p. 65 (type-locality, Philippines; type in Brit. Mus.; Cuming, collector).

Description.—Adult male: Christiania University Zoological Museum, No. 830; Formosa; Navara collector, 1894. Rostral pentagonal; the large semidivided nasals broadly in contact with each other behind the rostral; nostrils on upper side of snout; internasals small, triangular, separated widely from rostral, in contact with loreal; prefrontals smaller than nasals, in contact with internasals, loreal, prefrontal, supraocular, and frontal; frontal irregularly divided into four smaller scales; parietals broken up into small scales; supraoculars narrow; loreal lozenge-shaped; one high preocular; two suboculars separating eye from labials; one postocular; temporals 2 + 3, second row keeled; supralabials 10 on one side, 9 on the other, very high and narrow, the last three divided horizontally; 11 inferior labials, 4 in contact with anterior chin-shields; two pairs of chin-shields, the posterior nearly entirely lateral to the anterior; 25 scale rows, all keeled, except outer row; 145 ventrals; anal double; caudals, 63 pairs. Color (in alcohol) above ash gray with narrow blackish crossbands which do not reach the ventrals, about 25 between head and anus; a narrow blackish band from nostril, through eye, obliquely backward on the side of the neck; underside, including posterior supralabials and the three or four lower rows of scales whitish with numerous large blackish spots on the sides connected with the corresponding spot by irregular dark gray blotches across the ventrals; lower labials with a few small dusky spots.

Dimensions.

	mm.
Total length	570
Snout to vent	447
Vent to tip of tail	123

Variation.—The head scales of this species are subject to great variation. The frontal shield may be intact or broken up; eye may be surrounded by from four to six shields; internasals may be united, etc. The scale rows vary between 23 and 27, ventrals between 132 and 160, and subcaudals between 49–72.

Habitat.—This species lives in rivers and along the seacoasts of India east to Indo-China and the Philippines, and south to Ceylon and throughout the Malay countries and archipelago to Borneo, Celebes, Ceram, etc.

Its right to a place in this work is based upon a specimen collected in Formosa by Mr. Navara, and now in the zoological museum of the University of Christiania.

List of specimens of Hurria rynchops.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
Christiania	......	Male [a]	Formosa	1894	Mr. Navara	25	145	2	63	1,2,1	2+3	9–10

[a] Description, p. 305.

Subfamily CORONELLINÆ.

The coronelline snakes embrace a great variety of forms of arboreal or terrestrial habits, and consequently of the most different physiognomy. Having no grooved fangs of any description, they are of course nonpoisonous, although a few, like the *Dinodon*, with their vertical pupil, to some extent resemble various poisonous forms. But apart from the absence of grooves on the posterior maxillary teeth there seems to be no character by which they can be distinguished from the next subfamily.

Most of our snakes belong to this group, the genera of which may be identified by the following:

KEY TO THE GENERA OF CORONELLINE SNAKES KNOWN FROM JAPAN AND ADJACENT TERRITORY.

a^1 Scale rows round body in even numbers.......... *Zaocys*, p. 352.
a^2 Scale rows round body in uneven numbers.
  b^1 Anterior temporals present, separating parietals from supralabials.
    c^1 Median maxillary teeth differentiated from the others by intervals; pupil vertically elliptic.......... *Dinodon*, p. 356.
    c^2 Median maxillary teeth not differentiated from the others; pupil round.
      d^1 Scales with apical pits; head distinct from neck.
        e^1 More than one loreal.......... *Ptyas*, p. 345.
        e^2 One loreal only.
          f^1 Maxillary teeth increasing in size posteriorly; tail more than one-fourth of total length.......... *Zamenis*, p. 349.
          f^2 Maxillary teeth subequal; tail less than one-fourth of total length. *Elaphe*, p. 307.

d^2 Scales without pits; head not, or scarcely, distinct from neck.

e^1 Maxillary teeth posteriorly strongly enlarged; portion of rostral visible from above as great as its distance from frontal .... *Holarchus*, p. 353.

e^2 Maxillary teeth equal; portion of rostral visible from above less than its distance from frontal .... *Liopeltis*, p. 337.

f^2 No anterior temporal, parietal being in contact with supralabials............. *Calamaria*, p. 375.

Genus ELAPHE[a] Fitzinger.

1826. *Coluber* Boie, Isis, 1826, p. 209 (type, *C. flavescens;* not of Linnæus).

1833. *Elaphe* Fitzinger, in Wagler's Descr. et Icon. Amphib., III, text to pl. XXVII (type, *E. parreysii*).

1834. *Callopeltis* Fitzinger, in Bonaparte's Iconogr. Fauna Ital., fasc. VII (type, *C. leopardina*).

1840. *Elaphis* Bonaparte, Mem. Accad. Sci. Torino (2), II, Sci. Fis. Mat., p. 402 (emendation).

1843. *Pantherophis* Fitzinger, Syst. Rept., p. 25 (type. *Coluber guttatus*).

1843. *Calopeltis* Fitzinger, Syst. Rept., p. 26 (emendation).

1853. *Scotophis* Baird and Girard, Cat. N. Am. Rept., I, Serp., p. 73 (type, *Coluber alleghaniensis*).

1860. *Leptophidium* Hallowell, Proc. Phila. Acad., 1860, p. 497 (type, *L. dorsale*).

1860. *Proterodon* Hallowell, Proc. Phila. Acad., 1860, p. 498 (type, *P. tessellatus*).

1862. *Natrix* Cope, Proc. Phila. Acad., 1862, p. 338 (type, *Coluber flavescens;* not of Laurenti).

1864. *Phyllophis* Guenther, Rept. Brit. India, p. 295 (type, *P. carinata*).

The above synonymy refers chiefly to such names as have been employed in connection with species treated of in this work.

The generic name *Coluber* is commonly applied to this genus, but as will be shown under that heading further on, without strict observance of the rules of zoological nomenclature, inasmuch as the authors who have specifically selected types for a restricted genus *Coluber* have invariably selected species unknown to Linnæus at the time he instituted the genus. The first one to mention a specific type was Fleming, in 1822, but he selected a *Python* unknown to Linnæus. The next one was Boie,[b] who again selected a post-Linnæan species, namely, Scopoli's *C. flavescens*.

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[a] This name is apparently a blunder for *Elaphis*. The latter is generally considered as derived from ἔλαφος, a deer, referring either to the coloring of the snake, or to its swiftness. Aldrovandi, who seems to be the source whence the modern authors received the name, apparently considered it as of the same origin as *Elaps* and *Elops*. See Aldrovandi Serpentum et Draconum Historia, Chapter XV, "De Elaphe, sive Elape aut Elope."

[b] Isis, 1826, p. 209, and 1827, p. 518.

KEY TO JAPANESE, KOREAN, AND FORMOSAN SPECIES OF ELAPHE.

a^1 Scale rows 19.. *E. quadrivirgata*, p. 327.
a^2 More than 19 scale rows.
  b^1 Scale rows 21.
    c^1 Less than 195 ventrals................................ *E. rufodorsata*, p. 310.
    c^2 More than 195 ventrals................................ *E. conspicillata*, p. 334.
  b^2 More than 21 scale rows.
    c^1 One or two outer scale rows smooth, the others strongly keeled. *E. carinata*, p. 308.
    c^2 More than two rows of scales smooth.
      d^1 More than 85 pairs of subcaudals.
        e^1 Underside of tail black with a very distinct whitish band along the median suture between the subcaudals.
          f^1 Scale rows, 23–25; ventrals, 229–258; subcaudals, 90–111 pairs. *E. tæniurus*, p. 319.
          f^2 Scale rows, 25–27; ventrals, 251–260; subcaudals, 104–124 pairs. *E. schmackeri*, p. 322.
        e^2 Underside of tail not longitudinally striped....... *E. climacophora*, p. 324.
      d^2 Less than 85 pairs of subcaudals.
        e^1 Eleven to thirteen median scale rows distinctly keeled; parietal suture not longer than distance of frontal from rostral; postocular dark stripe crosses commissure in front of angle of jaw; color uniform or with wide dark spots and light cross bands...................... *E. schrenckii*, p. 313.
        e^2 Scales smooth with only faint traces of keels on the median ones; parietal suture longer than distance of frontal from nostral; postocular dark band reaches commissure at angle of mouth; color light with numerous narrow blackish cross bands.............................. *E. dione*, p. 315.

ELAPHE CARINATA[a] (Guenther).

1858. *Elaphis sauromates* GUENTHER, Cat. Colubr. Sn. Brit. Mus., p. 93 (Ningpo, China) (not of Pallas); Rept. Brit. India, 1864, p. 241 (part: Ningpo), pl. XXI, fig. E.

1864. *Phyllophis carinata* GUENTHER, Rept. Brit. India, p. 295, pl. XXI, fig. B (type-locality, China; type in Brit. Mus.); Ann. Mag. Nat. Hist. (6), I, 1888, p. 170 (Kiukiang).—*Elaphe carinata* STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 221 (Formosa).

1891. *Coluber phyllophis* BOULENGER, Ann. Mag. Nat. Hist. (6), VII, May, 1891, p. 280 (type-locality, Kiukiang, China; types in Brit. Mus.; Pratt, collector); Cat. Sn. Brit. Mus., II, 1894, p. 55 (Kiukiang; Ningpo); Proc. in Zool. Soc. London, 1899, p. 165 (Kuatun, Prov. Fokien).—GUENTHER, Ann. Mus. Zool. St. Pétersbourg, I, 1896, p. 205 (Prov. Szechuen).—WALL, Proc. Zool. Soc. London, 1903, p. 92 (China).—WERNER, Abh. Bayer. Akad. Wiss. (Muenich), II Klasse, XII, Pt. 2, 1904, p. 356 (Ningpo Mts. near Shanghai).

Description.—Adult male; Science College Museum, Tokyo, No. 5; Taipa, Formosa; December, 1897; T. Tada, collector (figs. 266–268). Rostral about one-third wider than high, largely visible from above; internasals longer than broad, nearly as long as prefrontals, the latter broadly in contact with supraocular; frontal considerably longer than wide, longer than its distance from rostral, but shorter than parietals, the sides strongly convergent backward, the width at the posterior lateral angle being less than width of supraocular; nostril large, between two nasals, the posterior of which is less than half as wide as the anterior; loreal much wider than high; one preocular, not in contact with frontal; a subpreocular; eye large, its diameter equaling half its distance from tip of snout; two postoculars; temporals 2 + 3; eight supralabials, seventh largest, fourth and fifth entering eye; five lower labials in contact with anterior chinshields, which are slightly longer than posterior; 23 rows of scales all strongly keeled except outer two rows; 214 ventrals, angularly bent laterally; anal divided; 97 pairs of subcaudals. Color (in alcohol) olive clay color, pale underneath; back with blackish ill-defined cross markings the black color only involving the edge of the scales and the skin between; a longitudinal blackish band on ventrals near the lateral angle and frequently interrupted; each ventral with the posterior edge irregularly marked with black; subcaudals narrowly edged with black so as to form a black median line; all the upper and lateral cephalic sutures marked with black.

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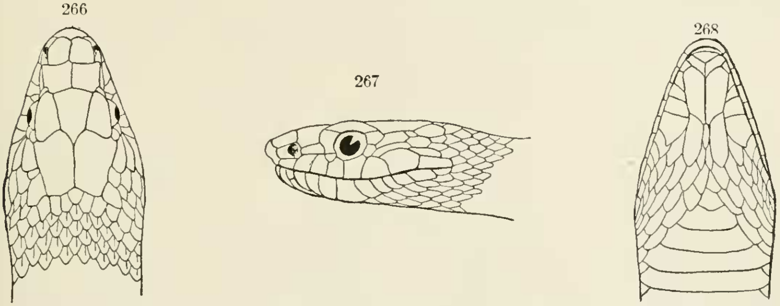
[a] Signifying keeled; with reference to the strong development of the keels of the scales.



Figs. 266–268.—Elaphe carinata. $\frac{2}{3}$ × nat. size. 266, top of head; 267, side of head; 268, underside of head. No. 5, Sci. Coll. Tokyo.

Dimensions.

	mm.
Total length	1, 455
Snout to vent	1, 155
Vent to tip of tail	300
Tip of snout to posterior end of parietals	34

The *young* (U.S.N.M. No. 36508) are much paler and underneath uniform white; back with a few scattered black dots which, on the anterior half of the body, form short and narrow cross lines; on posterior half an obscure, pale brown longitudinal line on each side; upturned ends of ventrals with small black dots, forming an irregular longitudinal series; upper and lower labials with dark brown sutures.

Variation.—The commonest variation is apparently in the number of temporals, the extremes recorded (for Chinese specimens) being 1 + 2 and 3 + 3. The scale rows are almost always 23, but Wall mentions a Chinese specimen with 21. Ventrals vary from 208 to 221 and caudals from 80 to 97. According to Boulenger an undivided anal and nine supralabials are rare features. Four lower labials in contact with anterior chin-shields as often as five. The above figures are derived from 17 specimens, of which only three are from Formosa.

This snake evidently grows to a great size, as Doctor Wall has recorded a specimen measuring 8 feet 1 inch (2.44 meters.).

Habitat.—Peculiar to China, where it has been obtained from near Shanghai, in the north, to Kuatun in Fokien in the south, and as far west as Lung-ngan-fu in the western part of the province of Szechuen.

In Formosa three specimens were collected by Mr. Tada in 1897, and a fourth specimen is in the zoological museum in Christiania, collected by Mr. Navara in 1894.

List of specimens of Elaphe carinata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Supralabials.	Temporals.
U.S.N.M....	36508	Young[a]	Formosa..........	1897. Sept. 29	T. Tada....	23	217	2	93	8	2–3
Sci. Coll. Tokyo.	10	....do...	.....do..............	Sept. —	.....do......	23	212	2	90	8	2–3
Do......	5	Male[b]..	Taipa, Formosa....	Dec. —	.....do......	23	214	2	97	8	2–3

[a] P. 309.

[b] Description, p. 308; figs. 266–268.

ELAPHE RUFODORSATA[a] (Cantor).

1842. *Tropidonotus rufodorsatus* Cantor, Zool. Chusan (pl. xiii) (type-locality, Chusan, China; types in Brit. Mus.; Cantor, collector).—*Coluber rufodorsatus* Swinhoe, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225 (Tamsui, Formosa).—Guenther, Rept. Brit. India, 1864, p. 238, pl. xx, fig. G.—Strauch, Mém. Acad. Sci. St. Pétersb. (7), XXI, no. 4, 1873, pp. 79, 270 (Khinggan; High Gobi; Dauria; Possiet Bay).—Mueller, Verh. Naturf. Ges. Basel, VII, Pt. 3, p. 681 (Tientsin).—Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, pp. 70, 130 (Shanghai); Ber. Senckenberg. Naturf. Ges., 1894, p. 140 (Luechan Mts., Hankow); p. 144 (Lake Sitai, near Shanghai); Kat. Schl. Mus. Senckenberg., 1898, p. 50 (Chinhai, near Ningpo).—Boulenger, Cat. Sn. Brit. Mus., II, 1894 p. 43 (eastern China, Formosa, Hainan).—Wall, Proc. Zool. Soc. London, 1903, p. 91 (China).—Werner, Abh. Bayer. Akad. Wiss. (Muenich), II Klasse, XXII, Pt. 2, 1904, p. 356 (Shanghai; Hankow).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1 (1905), p. 248 (Possiet Bay; Korea).—*Ablabes rufodorsatus* Boulenger, Ann. Mag. Nat. Hist. (6), V, Feb. 1890, p. 138 (eastern Siberia; Peking).

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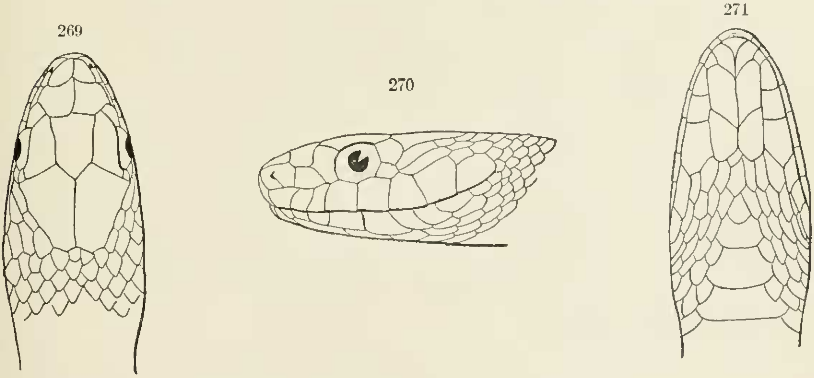
[a] Signifying red-backed.

1854. *Ablabes sex-lineatus* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, p. 324 (type-locality, China; types in Paris Mus.).—*Coronella sexlineata* Jan, Icon. Ophid., livr. 14, 1865, pl. vi, fig. 2 (China; type).

1886. *Simotes herzi* Boettger, Zool. Anzeig., IX, 1886 p. 519, (type-locality, hills near Shanghai; type in Mus. Senckenberg.; Herz, collector).



FIGS. 269-271.—ELAPHE RUFODORSATA. 2 × NAT. SIZE. 269, TOP OF HEAD; 270, SIDE OF HEAD; 271, UNDERSIDE OF HEAD. NO. 21192, U.S.N.M.

Description.—Adult female; U.S.N.M. No. 21192; Seoul, Korea; October 8, 1883; P. L. Jouy, collector (figs. 269–271). Rostral very much broader than high, just visible from above; internasals small, very narrow in front, suture between them considerably shorter than between prefrontals, which are large and in contact with supraocular; frontal slightly longer than its distance from tip of snout, as long as interparietal suture, slightly broader in front than behind, not in contact with preocular; parietals long; nostril small, semicircular, situated a little above the center of the larger semidivided nasal; loreal large, somewhat longer than high; one preocular, not in contact with frontal; no subpreocular; two postoculars, upper larger than lower; temporals 2 + 3; seven supralabials, third and fourth in contact with eye (on left side eight, fourth and fifth in contact); five lower labials, in contact with anterior chin-shields; posterior chin-shields shorter than anterior; 21 rows of smooth scales; ventrals 177; anal divided; 51 pairs of subcaudals; no ventral lateral keel. Color (in alcohol), above olive gray, with four series of small dark brown spots, the inner two ocellated, the outer solid, which on the posterior half of the body join to form four continuous dark bands, extending to the tip of the tail; top of the head with a very distinct V-shaped mark, angle forward on the frontal and limbs extending far back on the neck, the edges of the mark strongly outlined by blackish brown; a similarly colored fleur-de-lis-shaped figure on the fronto-parietal suture; a blackish brown angular line on the prefrontals, continuing backward obliquely through the eye to angle of mouth and sides of neck; underside whitish, ventrals outlined with black, and checkered with large square blotches; a black median line on the suture between the subcaudals.

Dimensions.

	mm.
Total length	561
Snout to vent	470
Vent to tip of tail	91

Variation.—The normal number of supralabials is seven, but occasionally eight are found; thus in both of our Korean specimens there are eight on one side, and Doctor Werner found a similar number among five Chinese examples. Twenty-one scale rows seem to be the constant number. Boulenger mentions that two preoculars occur rarely. In the Korean specimen in the museum of the Michigan University the temporals show the unusual number 1 + 2. Doctor Wall mentions that in 15 Chinese specimens examined by him only one had four lower labials in contact with anterior chin-shields. Ventrals range between 162 and 190, subcaudals between 47 and 68.

Habitat.—China, from Peking to Hainan, according to specimens in British Museum.[a] It occurs also in eastern Siberia from Lake Baikal to Amurland and Ussuri, where it has been taken at Vladivostok and Possiet Bay, near the Korean boundary, while the United States National Museum has two specimens collected by the late Mr. P. L. Jouy at Seoul, Korea, October 8, 1883. Another specimen from Korea, collected by Mr. G. A. Olinger, is in the museum of the Michigan University, and a third in the St. Petersburg Museum.

Swinhoe obtained it at Tamsui, in Formosa, and sent the specimens to British Museum.

List of specimens of Elaphe rufodorsata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Supralabials.	Temporals.
U.S.N.M	21191	Male	Seoul, Korea	1883. Oct. 8	P. L. Jouy	21	169	2	56	7-8	2+2-3
Do	21192	Female [a]	do	do	do	21	177	2	51	7-8	2+3
Mich. Univ	30526	Adult	Korea		G. A. Olinger	21	167	2	60	7	1+2
Brit. Mus	*m*	Female [b]	Formosa		R. Swinhoe	21	183	2	54		
Do	*n*	do [a]	do		do	21	178	2	49		

[a] Description, p. 311; figs. 269-271.

[b] Boulenger, Cat. II, p. 44.

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[a] As for the locality Hainan, see under *Elaphe dione*, p. 318, footnote.

ELAPHE SCHRENCKII[a] Strauch.

1873. *Elaphis schrenckii* Strauch, Mém. Acad. Sci. St. Pétersbourg (7), XXI, no. 4, pp. 100, 272 (type-locality, Khinggan Mil. Post, eastern Siberia; type, No. 3706 St. Petersb. Acad. Mus.; Schrenck, collector).—*Coluber schrenkii* Boulenger, Ann. Mag. Nat. Hist. (6), V, Feb. 1890. p. 139 (Ussuri River; Brit. Mus.); Cat. Snakes Brit. Mus., II, 1894, p. 48 (Ussuri R.; Seoul, Korea).—Wall, Proc. Zool. Soc. London, 1903, pp. 92, 100 (Amurland; Korea; N. Japan).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, 1905, p. 260 (Amurland; Korea, etc.).

1888. *Elaphis virgatus* Boettger, Offenbach. Ver. Naturk. 26–28 Ber., p. 72 (Korea; Mus. Senckenb.; Moellendorff, collector) (not of Schlegel).

1898. *Coluber schrencki* Boettger, Kat. Schl. Mus. Senckenberg., p. 51 (Korea).

Description.—Male adult; U.S.N.M. No. 21187; Seoul, Korea; August, 1887; P. L. Jouy, collector. Rostral much broader than high, visible from above; internasals longer than broad, much smaller than prefrontals, which are in contact with supraocular; frontal shorter than its distance from tip of snout, equaling interparietal suture, much wider anteriorly than behind, the sides strongly convergent backward; supraoculars narrower than frontal; parietals rather short, equaling frontal and half of interprefrontal suture; nostril large, round, between two subequal nasals; loreal longer than high; one preocular, not in contact with frontal; one small subpreocular (absent on left side); two postoculars (lower fused with fifth supralabial on right side); temporals 2 + 3; eight supralabials, seventh largest, fourth and fifth entering eye; four lower labials in contact with anterior chin-shields; posterior chin-shields shorter than anterior; 23 rows of scales, the median ones distinctly keeled, the keels becoming more and more indistinct on the sides, disappearing entirely on the outer four or five rows; 214 ventrals, with indistinct lateral angle; anal divided; subcaudals, 70 pairs. Color (in alcohol) above dark isabella-color, with scattered black specks occupying part of a scale; on the neck these spots become more numerous, and toward the tail the edges of the scales become dusky, with indications of longitudinal lines; head above like the back, with irregular dusky spots; supralabials whitish, except the last, all with black posterior edge; a black line obliquely from eye to edge of lip anterior to corner of mouth; indications of a pale black-edged line between nostril and eye; lower labials with dusky posterior edges; underside whitish, the anterior ventrals dark-edged.

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[a] For Dr. Leopold von Schrenck, the celebrated Russian naturalist and explorer of Amurland. He was born in the Kharkov government on April 24, 1826, and died in St. Petersburg on January 20, 1894, when director of the Anthropological-Ethnographical Museum of the Academy of Sciences. He traveled in eastern Siberia and in Sakhalin during 1854–1856.

Dimensions.

	mm.
Total length	1,580
Snout to vent	1,330
Vent to tip of tail	250

The *young* have a very characteristic head pattern. Thus, in the specimen in the Philadelphia Academy of Sciences (No. 15255), from Seoul, Korea, the ground color is brownish with white black-edged bands and spots, as follows: A broad band from upper postocular over temporals past the last supralabial, confluent with the white underside; a black line from lower postocular over suture between seventh and eighth supralabials to edge of lip; a white spot on frontal anteriorly, and a small one on each of the parietals near the frontal; an interrupted white cross band on supraoculars; a festooned white band across anterior half of prefrontals; a white spot on rostral; a white horizontal band from nostril to preocular; semicircular black markings on anterior supralabials; an inverted Y-shaped white mark on upper neck; back with rhomboidal brown black-edged spots separated by whitish cross bands.

Halfgrown specimens, such as U.S.N.M. No. 21189, show traces of this pattern, especially on the posterior part of the body and on sides of head; this specimen also has indication of a checker pattern on the underside.

Very old specimens are often nearly uniform pale isabella-color.

Variation.—Apparently the most variable feature of the scutellation of this species is the frequent absence of the subpreocular. Thus, out of 11 specimens Strauch found it lacking on both sides in five, while of my five Korean examples it is absent in three on one side. Only in one of our specimens is there a ninth supralabial on one side, while in the Michigan University specimen from Korea the number of supralabials is reduced to six on one side and seven on the other. The number of scale rows appears to be very constant, all the 19 specimens on record or examined by me having 23. The number of ventrals is also confined within narrow limits, namely, 208 to 226. The subcaudals do not exceed 76 and rarely go as low as 61. One specimen (U.S.N.M. No. 21186) has an undivided anal, and I also believe that it is undivided in the young specimen in the Philadelphia Academy of Sciences.

Habitat.—Eastern Asia from the River Argun, the tributary of the Amur, ranging east to the sea. The cotypes were collected in the Khinggan Mountains by Doctor Radde, according to Schrenck, but as I can not find that Radde ever visited the main body of this chain, which is situated in Chinese Manchuria, it is most likely that he obtained his specimens along the borders of the rivers Argun and Amur, which skirt the mountains mentioned. Dybowski collected it at Vladivostok and Posiet Bay, near the Korean frontier, and in Korea itself it has been collected more recently by Moellendorff, Campbell, Ferebee and Jouy. It seems to be rather common in Korea, especially around Seoul whence Jouy brought us four specimens.

Strauch enumerates two specimens in the St. Petersburg Museum as having been collected by Mr. Goschkewitsch in Japan, and as this gentleman was for some little time Russian consul in Hakodate, Strauch assumes that they were collected in Yezo. The occurrence of this species in Japan is entirely unconfirmed and the probability is that the specimens really came from the mainland opposite, though possibly shipped from Japan. In this connection it is well to remember that *Elaphe dione* is also credited to Yezo by the same authority on material from the same source. Neither the one nor the other species has been found on Japanese territory by other collectors.[a]

List of specimens of Elaphe schrenckii.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
				1883.							
U. S. N. M	14609	Male[a]	Korea		Dr. N. M. Ferebee	23	212	2	62	2+3	8
Do	21186	Female	Seoul, Korea	Oct 16	P. L. Jouy	23	226	1	....	2+3	8-9
Do	21187	Male[b]	do	Aug. —	do	23	214	2	70	2+3	8
Do	21188	Female	do	do	do	23	218	2	72	2+3	8
Do	21189	Male	do	do	do	23	225	2	70	2+3	8
				1890.							
Phila. Acad	15255	Young	do	Sept. —	Dr. W. H. Jones	23	....	....	70	2+3	7-8
Mich. Univ	30529	Adult	Korea		G. A. Olinger	23	219	2	72	2+2	6-7
Senckenberg		(c)	do		Moellendorff	23	226	2	70	....	....
Brit. Mus	*b*	Young[d]	Seoul, Korea		C. W. Campbell	23	210	2	68	....	....
Do	*c*	Male[e]	do		do	23	216	2	76	....	....
Do	*a*	Female[d]	Ussuri River			23	220	2	68	....	....
St. Petersburg	2997	(*f*)	Possiet Bay			23	209	2	70	....	....
Do	2955	(*f*)	[Japan?]		Goschkewitsch	23	219	2	....	....	....
Do	2956	(*f*)	do		do	23	211	2	71	....	....

[a] Total length, 1,635 mm.
[b] Description, p. 313.
[c] Boettger.
[d] Boulenger, Cat. II, p. 48.
[e] Boulenger, p. 49.
[f] Strauch, p. 272.

ELAPHE DIONE[b] (Pallas).

1773. *Coluber dione* Pallas, Reise Russ. Reichs, II, p. 717 (type-locality, "Salt steppes toward the Caspian Sea").—Boulenger, Ann. Mag. Nat. Hist. (6), V, Feb., 1890, p. 138 (Ussuri River; Peking); Cat. Sn. Brit. Mus., II, 1894, p. 44 (southern Russia to Japan).—Boettger, Ber. Senckenberg. Naturf. Ges., 1894, p. 149 (Chefu, China); Kat. Schl. Mus. Senckenberg., 1898, p. 51 (Chefu; Turkestan).—Stone, Proc. Phila. Acad., 1899, p. 184

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[a] See also under *Agkistrodon blomhoffii*, p. 452.

[b] From *Διώνη*, a name in Greek mythology, the mother of Aphrodite.

(northern Pechili, China).—Méhely, Zichy's Dritte Asiat. Forschungsr., II, 1901, p. 58 (Peking).—Wall, Proc. Zool. Soc. London, 1903, p. 91 (China).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1, 1905, p. 249 (Vladivostok, Korea, etc.).—*Elaphis dione* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, p. 248.—Guenther, Rept. Brit. India, 1864, p. 240 (Kaukasus; Peking).—Jan, Icon. Ophid., livr. 21, 1867, pl. III, fig. A (Sarepta, Russia).—Strauch, Mém. Acad. Sci. St. Pétersb. (7), XXI, No. 4, 1873, pp. 82, 270 (eastern Russia, Siberia, Amur, Ussuri, Korea, Japan); in Przevalski's Mongoliya i Strana Tangutov, III, 1876, p. 46 (Ordos).—Moellendorff, Journ. N. China Br. R. Asiat. Soc. (n. s.), XI, 1877, p. 104 (Peking; Manchuria).—Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 131 (East Europe to North China and Korea).—Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 356 (Tsingtau, China; Peking).

1802. *Coluber diana* Latreille, Hist. Nat. Rept., IV, p. 159 (emendation).

1831. *Coluber eremita* Eichwald, Zool. Special., III (p. 174).

1837. *Coluber maeoticus* Rathke, Mém. Sav. Étrang. Acad. St. Pétersb., III, p. 433, pl. I, figs. 9–11 (type-locality, Caspian Sea at the mouth of Riv. Ural; Goebel, collector).

Description.—Adult male; U.S.N.M. No. 14610; Korea; Dr. N. M. Ferebee, collector. Rostral much broader than high, visible from above; internasals much broader than long, only half as long as prefrontals which are broadly in contact with supraocular; frontal nearly as long as its distance from tip of snout, somewhat wider in front than behind; parietals longer than frontal, interparietal suture longer than distance of frontal from rostral; nostril large, between two nasals, the anterior slightly larger than the posterior; loreal longer than high; one preocular, not in contact with frontal; one subpreocular; two postoculars; temporals 2+3; eight supralabials, seventh largest, fourth and fifth entering eye; five lower labials in contact with anterior chin-shields, which are as long as the posterior; 25 rows of nearly smooth scales; 204 ventrals; anal divided; 65 pairs of subcaudals. Color (in alcohol) light tawny-olive above, with numerous irregular narrow dusky crossbars, about one to one and a half scale wide; head with slightly darker, black-edged markings consisting of an irregular chevron mark on parietals and upper neck, a cross mark on prefrontals and frontal extending backward obliquely through eye and reaching commissure at the angle of mouth; supralabials, including lower edge of seventh and eighth, pale yellow; underside pale yellowish with irregular dusky spots which near the obtuse lateral angle of the ventrals assume the character of an interrupted longitudinal line.

Dimensions.

	mm.
Total length	825
Snout to vent	677
Vent to tip of tail	148

In the *young* (No. 21193) (fig. 272) the markings are darker and more distinct; the pattern on the head shows a fleur-de-lis figure on the interparietal suture; the lateral dark spots on the underside are blacker, broader, with a convex anterior outline; there are three pale dorsal lines, the median one not well defined and interrupted by the dark crossbars, the lateral ones on the fifth, sixth, and seventh scale rows continuous and cutting off a series of blackish lateral spots from the dorsal dark crossbars.

This pattern is often retained in tolerably large specimens.

Variation.—The variation in our Korean material is quite insignificant; thus all possess a subpreocular, but, as might be expected in a species of so wide distribution, many anomalies are found when a large series is studied. Strauch examined 84 specimens from nearly the entire range, and has enumerated the deviations he found. Thus five specimens lacked the subpreocular on both sides and five on one side; thirteen had three postoculars on both sides and six had three on one side; four specimens had nine supralabials on both sides and two specimens only seven on both sides, while eleven had nine or seven on one side only. The number of scale rows varies in about even proportions between 23 and 25 in 43 specimens.[a] As to the subcaudals, Strauch mentions as a curious anomaly only found in some east Siberian and west Chinese specimens that some of the subcaudals are entire.

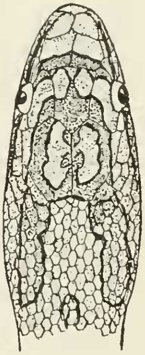

FIG. 272.—ELAPHE DIONE. 2 × NAT. SIZE. TOP OF HEAD. No. 21193, U.S.N.M.

The number of ventrals varies between 172 and 214. In this a slight tendency to geographical variation can be traced. Thus in 42 specimens from Siberia the ventrals vary between 180 and 214 in those west of the Yenisei River, but between 172 and 195 in those from east of that river. In 17 Chinese specimens they vary again between 180 and 213 ventrals, while in five Korean specimens the number is 203–207.

One of our specimens (No. 21190) shows the anomaly of having on both sides a small shield cut off from the third supralabial between it and the loreal. Another (No. 14331) has two presuboculars on each side.

Habitat.—A species of extraordinarily wide distribution, ranging, as it does, from the valley of the Volga in southeastern Russia through temperate Asia to the Amur country in the north and south through eastern China to Kiukiang, and possibly even to the island of Hainan.[a]

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[a] Curiously enough, in 21 specimens in British Museum enumerated by Boulenger, of which 12 were from China, from which country Strauch had no specimens, 13 have 25 scale rows, 6 have 27, and only 2 have 23. All our Korean specimens have 25, and I am inclined to regard this as the normal number. This agrees with Doctor Wall, who found 23 in 3, 25 in 10, and 27 in 1 Chinese specimens, and with Doctor Werner, who in 4 specimens from China found 3 with 25 and 1 with 27 scale rows, the latter in a specimen from Tsingtau.

Dybowski, according to Strauch, collected it on the banks of the Amur between Seljonoi-Less and Khabarovka, and also at Posiet Bay. It is also recorded from the Ussuri, the Sungari, and upper Amur, and the Hamburg Museum has a specimen each from Vladivostok and Pokrovka, collected by Dieckmann (Nos. 2168, 2169). The St. Petersburg Museum also has a specimen from Vladivostok, collected by Doctor Zander.

Schrenck and Doctor Ferebee obtained specimens in Korea and Jouy brought home three specimens from Seoul.

Two specimens obtained in 1861 by the St. Petersburg Academy from the Russian consul in Hakodate, Mr. Goschkewitsch, are credited by Strauch to Japan, but, as explained under the head of *Elaphe schrenckii*, I do not place any faith in their having been collected in any of the Japanese islands.

List of specimens of Elaphe dione.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M.	14321	Young	Ala Tan, Siberia.		Mus. St. Petersb.	25	207	2	61	3+4	8
Do	14331	Female[a]	Amur land		do	25	192	2	50	2+4	8
Do	14610	Male[b]	Korea		Dr. N. M. Ferebee.	25	204	2	65	2+3	8
Do	21190	Female[a]	Seoul, Korea	1883. Oct. 8	P. L. Jouy	25	205	2		2+3	8
Do	21193	Young[c]	do	June, —	do	25	207	2	71	2+3	8
Do	21194	Female	do	Aug. —	do	25	204	2	68	2+2—3	8—9
Brit. Mus.	h.	Male[d]	Ussuri River		Warsaw Mus.	23	179	2	60		
St. Petersb.	2910	([e])	Bikinda, Ussuri.			25	183	2			
Do	2911	([e])	Dshare, Amur			25	195	2	61		
Do	2953	([e])	[Japan?]		Goschkewitsch	23	194	2	58		
Do	2954	([e])	do		do	23	180	2	62		
Do	3704	([e])	Korea			23	203	2	59		

[a] P. 317. [b] Description, p. 316. [c] Fig. 272. [d] Boulenger, Cat. II, p. 45. [e] Strauch, p. 271.

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[a] This locality is given on the authority of a specimen in British Museum said to have been collected at Hojhow by J. Neumann. It should be noted in this connection, however, that several rather more northern forms have been attributed to the same locality upon material received from the same source, such as *Natrix tigrina*, *Dinodon rufozonatus*, *Zamenis spinalis*, *Elaphe rufodorsata*, *Agkistrodon blomhoffii*. None of these species have been found in that island by other collectors (see BOETTGER, Liste der von der Insel Hainan bekannten Kriechthiere, in Ber. Senckenberg. Naturf. Ges., 1894, pp. 129–136.—COPE, On a Collection of Batrachia and Reptilia from the Island of Hainan, in Proc. Phila. Acad., 1894, pp. 423–428.—BOULENGER, On the Reptiles, Batrachians, and Fishes collected by the late Mr. John Whitehead in the Interior of Hainan, in Proc. Zool. Soc. London, 1899, pp. 956–962, pls. LXVI–LXIX), and the suggestion that these northern species might have come from the mountainous interior is not supported by the result of Whitehead's expedition. It seems most conservative, therefore, to wait for corroboration before the island of Hainan be given as an undoubted locality for those species.

ELAPHE TÆNIURUS[a] Cope.

1858. *Elaphis virgatus* Guenther, Cat. Colubr. Sn. Brit. Mus., p. 95 (part: specimen *c*, Chikiang, China) (not of Schlegel).

1860. *Elaphe tæniurus* Cope, Proc. Phila. Acad., 1860, p. 565 (type-locality, Ningpo, China, type in Phila. Acad. Mus.; McCartee, collector).—*Elaphis tæniurus* Guenther, Rept. Brit. India, 1864, p. 242 (Chikiang; Ningpo).—Strauch, Mém. Acad. Sci. St. Pétersb. (7), XXI, no. 4, 1873, pp. 103, 272 (Possiet Bay).—Moellendorff, Journ. N. China Br. R. Asiat. Soc. (n. s.), XI, 1877, p. 104 (Tachiosse, NW. of Peking).—Boulenger, Ann. Mag. Nat. Hist. (5), XIX, 1887, p. 170 (part: Chikiang; Shanghai; Peking).—Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, pp. 71, 131 (Shanghai; Formosa).—*Coluber tæniurus* Boulenger, Fauna Brit. India, Rept., 1890, p. 333 (part: Manchuria; China; Darjeeling); Ann. Mag. Nat. Hist. (6), V, Feb. 1900, p. 139 (hills northwest of Peking); Cat. Snakes Brit. Mus., II, 1894, p. 47 (part: western hills of Peking; Shanghai; Chikiang; mountains of Kiukiang; Darjeeling).—Boettger, Ber. Senckenberg. Naturf. Ges., 1894, p. 138 (South Cape, Formosa); p. 144 (Wusung near Shanghai); Kat. Schl. Mus. Senckenberg., 1898, p. 51 (Shanghai; Formosa).—Wall, Proc. Zool. Soc. London, 1903, p. 92 (Yangtze Valley; Shanghai).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, 1905, p. 259 (Possiet Bay; Novgorodsk).

1879. *Elaphis yunnanensis* Anderson, Zool. Res. Yunnan Exped., p. 813 (type-locality, Momien, Yunnan).

Several forms of varying degree of distinctness seem to cluster around *E. tæniurus*[b] The typical form which extends from the Himalayas over China and Korea to the Amur Province is characterized by having 23–25 scale rows, 226–258 ventrals, and 90–111 subcaudals, a formula derived from about 20 specimens. A slightly differentiated form with 25–27 scale rows, 251–260 ventrals, and 104–124 subcaudals inhabits the southern group of the Riu Kiu Islands, as demonstrated by 5 specimens examined by me. This is Boettger's *Coluber schmackeri*. Finally, the form which Fischer called *E. grabowskyi*[c] seems clearly entitled to recognition, there being a considerable gap between typical *E. tæniurus* and the specimens from Borneo, Sumatra, and the Malay peninsula so far as the scale formula is concerned, which in four specimens is as follows: 25 scale rows, 278–295 ventrals, 94–111 subcaudals.[a]

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[a] From ταινία, band; οὐρά, tail.

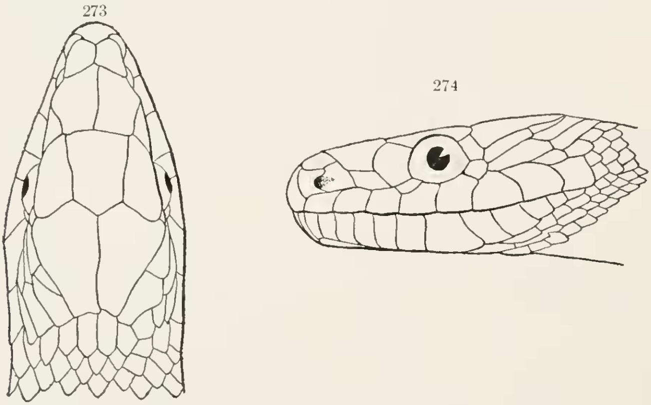
[b] *Coluber tæniurus ridleyi* Butler, Journ. Bombay Nat. Hist. Soc., XII, 1899 (p. 426), is unknown to me, as that publication is not now received in Washington.

[c] 1885. *Elaphis grabowskyi* Fischer, Archiv Naturg., LI, Pt. 1, 1885, p. 59 (author's separate p. 19), pl. iv, figs. 3*a–e* (type-locality, Batu Hapu, Pengaron, southeast Borneo; type in British Museum; Grabowski, collector).

1887. *Elaphis tæniurus* Boulenger, Ann. Mag. Nat. Hist. (5), XIX, p. 170 (part: Pajo, Sumatra).—*Coluber tæniurus* Boulenger, Cat. Sn. Brit. Mus., II, 1894, p. 47 (part: SE. Borneo; Sumatra).—Flower, Proc. Zool. Soc. London, 1899, p. 668 (Kuala Lumpar, Malay peninsula).

I have added the last reference on the strength of a specimen in the United States National Museum (No. 26234) collected by Dr. W. L. Abbott in Trong, Lower Siam. It is undoubtedly an *E. grabowskyi* with 25 scale rows, 295 ventrals, and 111 subcaudals; 9 supralabials, and preoculars *broadly* in contact with frontal. Mr. Flower gives no scale formulas of his specimens, but it seems highly probable that they are the same as Abbott's.

Description.—Adult male; U.S.N.M. No. 14608; Korea; Dr. N. M. Ferebee, collector (figs. 273, 274). Rostral slightly broader than high, largely visible from above; internasals longer than broad, half as large as prefrontals, which are narrowly in contact with supraocular; frontal equaling its distance from rostral, a little shorter than interparietal suture, somewhat broader in front than behind; parietals longer than the distance of frontal from tip of snout, strongly convergent behind; nostril rounded, large, between two nasals, the posterior slightly larger than the anterior; loreal lozenge-shaped, longer than high; one preocular, not in contact with frontal; one small subpreocular; two postoculars; temporals 2+3 (on left side 2+4); eight supralabials, posterior ones not specially enlarged, fourth and fifth entering eye; six lower labials in contact with anterior chin-shields (on left side seven), first pair rather elongate; chin-shields subequal; 25 rows of scales, of which the outer seven on each side are smooth or nearly so, the others feebly but distinctly keeled; 229 ventrals, with a distinct lateral angle; anal divided; subcaudals, 111 pairs. Color (in alcohol) pale olive clay-color above; on the middle of the back a black rope-ladder pattern, consisting of two narrow lateral black lines at regular intervals connected by a black cross line of approximately the same width, this pattern gradually disappearing on the posterior third of the body; on the sides two or three ill-defined series of irregular black spots which on the posterior third of the body gradually consolidate



FIGS. 273–274.—ELAPHE TÆNIURUS. 1⅓ × NAT. SIZE. 273, TOP OF HEAD; 274, SIDE OF HEAD. NO. 14608, U.S.N.M.

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[a] Two of the specimens, the scale formulas of which are here included, viz, Doctor Fischer's two original specimens, now in British Museum, have respectively 278 and 282 ventrals and 98 and 94 subcaudals according to Boulenger's count. Fischer himself, in the original description, counted 281–284 ventrals and 101–104 subcaudals.

into a broad (about 6 scale rows) longitudinal blackish band with vertical series of white spots about four scales apart; underside pale yellowish with a dusky spot on each ventral at the lateral angle, these spots posteriorly consolidating into a broad black longitudinal band separated from the lateral broad band by a white one which occupies outer scale-row and the adjacent portion of the upturned ventral; these bands are continued on the tail to the tip, so that the tail is black with four whitish or yellowish bands, one on the median line underneath, one on the median line above, and one on each side; head above uniform clay-color with a broad, horizontal postocular black band which ends above the angle of the mouth but does not reach it; a small dusky spot on preocular; labials and throat uniform unspotted pale yellowish.

Dimensions.

	mm.
Total length	1,345
Snout to vent	1,030
Vent to tip of tail	315

The *young* are essentially colored like the above, except that the markings are more sharply defined; the vertical light marks on the lateral black band are suffused with brownish; top of head without any marks whatever.

Variation.—This species, which appears to be so constant in coloration, on the other hand is rather variable in its scutellation. Thus of about 22 specimens three are recorded as having an undivided anal; the temporals are rather variable, from 1+2 to 2+4; nine supralabials are sometimes noted; Doctor Wall records a specimen in which the loreals were confluent with prefrontals on both sides. As stated before, the number of ventrals ranges between 226 and 258, and the subcaudals between 90 and 111. The majority of specimens recorded seems to have 25 scale rows, but in about 40 per cent the number is 23.

The relation of the preocular to frontal and consequently the prefrontal to supraocular is also variable. As a rule, I believe the latter are in contact, but in one of our specimens (No. 31718) they are separated by the preocular being broadly in contact with the frontal.

Habitat.—Ranging from Darjeeling in the west to Formosa and the Amur Province in the east, this species has the regular Himalayo-Chinese distribution. The extreme northeastern point from which it has been recorded is Possiet Bay, in the Amur Province near the Korean boundary, but it seems to be common in the mountains west and northwest of Peking. A fine large specimen is in the U. S. National Museum (No. 14608) collected in Korea by Doctor Ferebee.

Doctor Boettger reports two specimens in Museum Senckenbergianum from Formosa, though without recording their scale formula. However, as he is the author of *E. schmackeri* and also had specimens from Shanghai for comparison the determination can not well be doubted.

List of specimens of Elaphe tæniurus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M...	7499	Young..	China..........	....	W. Stimpson ...	25	230	2	95	1+2	8–9
Do.....	14608	Male[a] ..	Korea..........	....	Dr.N.M.Ferebee.	25	229	2	111	2+3-4	8
Do.....	31718	Young..	Shanghai, China	....	E. Deschamps...	25	233	2	103	2+3	8–9
St.Petersb.	3192	([b])	Possiet Bay....	....	Butakow........	23	231	2	98	....	....

[a] Description, p. 320; figs. 273-274. [b] Strauch, p. 272.

ELAPHE SCHMACKERI[a] (Boettger).

1895. *Coluber schmackeri* Boettger, Zool. Anz., XVIII, 8 July, 1895, p. 268 (type-locality, Mijakoshima, Sake shima group, Riu Kiu.; type in Mus. Senckenberg.; Schmacker, collector); Kat. Schl. Mus. Senckenberg., 1898, p. 53.—Boulenger, Cat. Sn. Brit. Mus., III, 1896, p. 627.—Wall, Proc. Zool. Soc. London, 1903, p. 101 (Loo Choos); 1905, II, p. 515 (Ishigaki).

Notwithstanding the fact that its original describer, Doctor Boettger, compares this form with *E. moellendorffii*, I can only regard it as an offshoot of *E. tæniurus*. In fact I have hesitated long whether it would not be most consistent to call it *Elaphe tæniurus schmackeri*, as the scale formulas plainly intergrade. However, as long as my colleagues are satisfied with the binominal appellation I can have no objection.

This species, which in Iriomote shima is known as "Ki-tokara" according to Doctor Lenz, is so closely related to *Elaphe tæniurus* that a separate description seems unnecessary. The coloration is identical. The main differences in scutellation are the greater number of scale rows, ventrals, and subcaudals, and the somewhat feebler carination of the dorsal scales. Thanks to the kindness of Doctor Boettger I have been able to examine his type specimen in Museum Senckenbergianum and satisfied myself that it has keels, though very faint ones, on the median scales. In the Hamburg Museum specimen I found very weak keels on the median scales while about eight lateral rows on each side are practically smooth, and in the specimen before me now (No. 5, Sci. Coll. Tokyo, figs. 275–276) the outer nine scale rows are smooth, but the seven middle ones have distinct though feeble keels. This specimen measures as follows:

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[a] For the late Mr. B. Schmacker, of Shanghai.

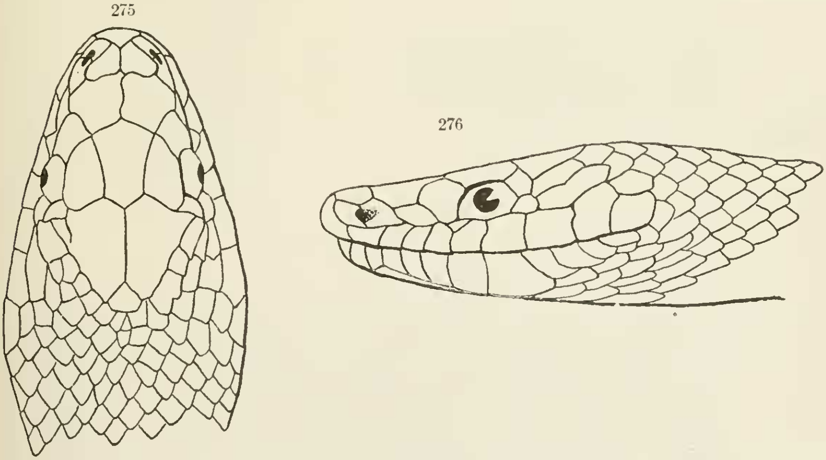
Dimensions.

	mm.
Total length	1,870
Snout to vent	1,445
Vent to tip of tail	425

The type as recorded by Doctor Boettger measures 2,080 mm. in total length, of which 445 belong to the tail. This species consequently grows to a considerable size.

Variation.—Very much as in *Elaphe tæniurus*, though the range between the extremes of the number of ventrals and subcaudals is much less, as might be expected from the much more restricted habitat.

In most specimens the preocular is not in contact with the frontal, but in the Hamburg Museum specimen these two shields touch on the right side, and in the specimen before me (No. 5) they practically touch on both sides. In the type, on the contrary, they are widely separated.



Figs. 275–276.—Elaphe schmackeri. Nat. size. 275, top of head; 276, side of head. No. 5, Sci. Coll. Tokyo.

A single anal is found in No. 89, Science College Museum, and in this the lower temporals of both rows are consolidated so as to make only 2 + 2 temporals, but normally they are 2 + 3.

In the Hamburg Museum specimen there are 10 supralabials and the Ishigaki shima specimen recorded by Dr. Wall has ten on one side.

Habitat.—So far as known, this form of *E. tæniurus* is confined to the southern group of the Riu Kius. The type in Museum Senckenbergianum is supposed to be from Miyakoshima, from which island there is also a large specimen with mutilated tail in the Imperial Museum, Ueno Park, Tokyo (No. 6), and another in Science College Museum, Tokyo (No. 5). Another large specimen (No. 89) is in the same museum, collected by Mr. Tashiro in Iriomote shima, and a specimen from the same island in the Hamburg Museum (No. 2590) collected by Doctor Lenz on March 13, 1897, was obtained in the mountains of the interior, according to a note attached to it.. Dr. Wall has recently recorded a specimen from Ishigaki shima.

List of specimens of Elaphe schmackeri.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
Sci. Coll., Tokyo.	5	Male [a]	Miyako shima	....	....	25	251	2	117	......	9
Imp. Nat. Tokyo.	6	Adult	do	....	....	27	254	2	....	2+2-3	9
Sci. Coll., Tokyo.	89	do	Iriomote shima.	1888. June 14	Tashiro	25	259	1	118	2+3	9
Hamburg	2590	....	do	1897. Mar. 13	Doctor Lenz	27	254	2	124	2+3	10
Senckenberg	8056.2 [a]	Male [b]	Miyakoshima	....	B. Schmacker.	27	260	2	104	......	....

[a] P. 323, figs. 275-276.

[b] Type.

ELAPHE CLIMACOPHORA[a] (Boie).

AODAISHŌ.

1826. *Coluber climacophorus* Boie, Isis, 1826, p. 210, (type-locality, Japan; Blomhoff, collector).—Boulenger, Cat. Sn. Brit. Mus., II, 1894, p. 54 (Nagasaki; Nikko; Miyanoshta; Mt. Onsen, Shimabara).—Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 52 (Hakone Mts.; Miyanoshta; Nikko).—Wall, Proc. Zool. Soc. London, 1903, p. 100 (Nikko); 1905, II, p. 514 (Hondo).—Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 356 (Tsingtau and Hankow, China).

1837. *Coluber virgatus* Schlegel, Phys. Serp., I, p. 146; II, p. 145 (type-locality, Japan; types in Leiden Mus.; Buerger and Siebold, collectors) (not of Bonnaterre, 1790).—Schlegel and Temminck, Fauna Japon., Rept., 1837, pp. 83, 139 (Japan).—*Elaphis virgatus* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, 1854, p. 261 (Japan).—Bleeker, Natuurk. Tijdschr. Nederland. Indië, XVI, 1858, p. 204 (Japan).—Jan, Icon. Ophid., livr. 21, 1867, pl. I (Japan).—Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 113 (Tokyo).—Okada, Cat. Vert. Japan, 1891, p. 68 (Tokyo; Osaka; Awaji; Nagato; Yezo).—Wall, Journ. Bombay Soc. Nat. Hist., XIV, 1902, p. 375 (Arima).—*Elaphis virgata* Martens, Preuss. Exped. Ost-Asiens, Zool., I, 1866, p. 111; 1876, p. 379 (Yokohama).—Hilgendorf, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, 1876, p. 29 (Tokyo).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, heft 46, 1891, p. 238 (Yezo).

1837. *Coluber quadrivirgatus* Temminck and Schlegel, Fauna Japon., Rept., Ophid. pl. II (error; not of the text).

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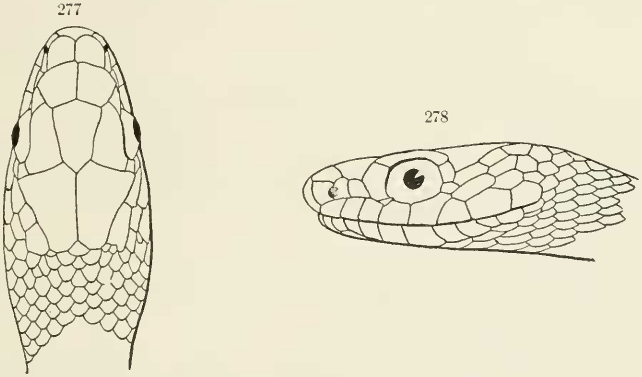
[a] From *κλῖμαξ*, ladder, *φορος*, carrying; referring to the pattern on the back.

Description (figs. 277–278).—*Adult male;* U.S.N.M. No. 31874; Kochi, Shikoku; May, 1902; Dr. H. M. Smith, collector. Rostral visible from above, much broader than high; internasals about as broad as long, smaller than prefrontals which are in contact with supraocular; frontal as long as its distance from rostral and as the interparietal suture, much broader in front than behind; parietals longer than distance of rostral from tip of snout, much narrowed and pointed behind; nostril large, rounded, between two subequal nasals; loreal longer than high; one preocular, not in contact with frontal; one subpreocular; two postoculars; temporals 2 + 3; supralabials eight, seventh largest, fourth and fifth entering eye; four lower labials in contact with anterior chin-shields, which are of about the same length as the posterior; 23 rows of scales, most of which are distinctly keeled, but outer two rows, at least, perfectly smooth; 228 ventrals; anal divided; 111 pairs of subcaudals; the ventrals angularly bent laterally. Color (in alcohol) dark umber brown above with four somewhat obscure darker longitudinal bands, the lower ones occupying four scale rows, viz, second to fifth, the upper ones three rows, viz, eighth, ninth, and tenth; head uniform, with a blackish oblique band from eye backward to the edge of the lip crossing and occupying the whole of the last supralabial; other supralabials pale, lower labials and throat whitish; rest of underside bluish slate gray, the ventrals pale-edged behind and with the lateral angle marked by a narrow longitudinal line.



Figs. 277–278.—Elaphe climacophora. 2 × nat. size. 277, top of head; 278, side of head. No. 36551, U.S.N.M.

Dimensions.

	mm.
Total length	1, 365
Snout to vent	1, 040
Vent to tip of tail	325

The *young*, for instance No. 34050, have no longitudinal dark bands; on the back there are numerous brown transverse, black-edged spots, separated by whitish cross bands and alternating on the sides with a series of brown spots; whole underside whitish, posteriorly with dark edges to the ventrals; an oblique blackish band from eye backward crossing the last supralabial, but otherwise no pattern on head; supralabials narrowly edged with dusky.

Variation.—Only one specimen with an undivided anal is recorded. The subpreocular is more variable; it is absent on one side in our No. 34003; in the Hamburg Museum No. 2427 it is lacking on both sides, though indicated on the right side by a minute granule; Doctor Wall has found it absent in one specimen in a lot of eleven; Hilgendorf in 16 specimens found it absent in one on both sides and on one side in one. He also found three postoculars on both sides in two specimens and on one side in one specimen, while one postocular only was present once on both sides and twice on one side. Doctor Wall records two specimen, with three anterior temporals on both sides. In all specimens examined by me the prefrontals are in contact with supraocular. The two specimens from Shikoku have the parietals unusually pointed behind. In the young the frontal is longer relative to its distance from tip of snout.

The normal number of scale rows appears to be 23, but 25 per cent of the specimens recorded below have 25. Ventrals range between 224 and 244, subcaudals between 97 and 122.

Habitat.—Formerly believed to be confined to Japan proper where it appears to be common from Kiusiu to Yezo, there being numerous specimens from various localities in the museums.[a] Doctor Werner has recently recorded two specimens in the Munich Zoological Museum said to have been collected by Doctor Haberer in Tsingtau and Hankow, China. It should be remembered, however, that he also collected in Japan and that he has credited two more Japanese species to China, which have not been obtained there by any other collector (see pp. 331, 336).

There are two specimens (No. 7) in the Imperial Museum, Ueno Park, Tokyo, which are said to be from Okinawa shima, but the locality given is almost certainly erroneous.

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[a] Tokyo; Mount Fuji; Yokohama; Kochi, Shikoku (U. S. Nat. Mus.). Mount Onsen, Shimabara, Kiusiu; Nagasaki; Nikko; Miyanoshta (Brit. Mus.). Tokyo; Nikko (Sci. Coll. Tokyo). Hakone Mts; Miyanoshta.; Nikko (Mus. Senckenberg.). Nagasaki; Yamato; Kawachi (Hamburg Mus.). Nagasaki (Stockholm Mus.).

List of specimens of Elaphe climacophora.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M	4678	Halfgr.	Japan		Doctor Morrow.	25	228	2	102	2+3	8
Do	31872	Male	Kochi, Shikoku.	1903. May —	Dr. H. M. Smith.	25	234	2	107	2+3	8
Do	31874	do.[a]	do	do	do	23	228	2	111	2+3	8
Do	34002	Female	Yokohama	1902. May 2	A. Owston	23	236	2	103	2+2	8-9
Do	34003	Male	do	do	do	23	226	2	99	2+3	8
Do	34027	Young	Mount Fuji	1898. Aug. —	do	23	224	2	101	2+3	8
Do	34050	do	do	do	do	23	226	2	110	3—2+3	8
Do	36551	do.[b]	Tokyo?		Sci. Coll. Tokyo.	25	231	2	102	2+2	8
Hamburg	2427	Male	Kawachi	1896. Jan. —	T. Lenz	23	236	2	99		8
Leiden	386	([c])	Japan		von Siebold		230		114		
Do	390		do	1861.	do		233		98		
Imp. Mus. Tokyo.	7		[Okinawa ? ?]			23	231	2		2+3	8
Brit. Mus	*a*	Female[d]	Japan		Leiden Mus	23	231	2	100		
Do	*b*	Halfgr[d]	do		do	23	234	2	112		
Do	*c*	Young[d]	do		Sir R. Owen	23	222	2	108		
Do	*d*	do.[d]	do		Mr. Adams	23	232	1			
Do	*e*	Female[d]	Nagasaki		Mr. Whitely	23	234	2	103		
Do	*f*	Young[d]	do		do	23	235	2	116		
Do	*g*	do.[e]	Nikko		do	23	229	2	103		
Do	*h*	do.[e]	Miyanoshta		J. H. Leech	25	232	2	100		
Do	*i*	do.[e]	do		do	23	226	2	97		
Do	*k*	Male	Mount Onsen, Shimabara.		P. Holst	25	234	2	99		

[a] Description, p. 325.
[b] Figs. 277-278..
[c] Type of *C. virgatus*.
[d] Boulenger, Cat. II, p. 54.
[e] Boulenger, Cat. II, p. 55.

ELAPHE QUADRIVIRGATA[a] (Boie).

SHIMAHEBI.

Plate XXI.

1826. *Coluber quadrivirgatus* BOIE, Isis, 1826, p. 209, (type-locality, Japan; Blomhoff, collector); Bijdr. Natuurk. Wetensch., II, Pt. 1, 1827, p. 256.—SCHLEGEL, Phys. Serp., 1837, I, p. 146; II, p. 147, pl. v, figs. 15, 26 (Japan).—TEMMINCK and SCHLEGEL, Fauna Jap., Rept., 1837, pp. 84, 139 (Japan).—BOULENGER, Cat. Sn. Brit. Mus., II, 1894, p. 59 (Yokohama; Nikko; Miyanoshta; Kumamoto; Satsuma; Gensan, Korea).—BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 53 (Nikko; Yezo).—WALL, Proc. Zool. Soc. London, 1903, p. 100 (Japan); 1905, II, p. 514 (Hondo; Yaku Is.).—WERNER, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 357 (Hankow, China).—NIKOLSKI, Zap. Imp. Akad. Nauk,

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[a] Signifying four-striped.

S. Peterburg (8), XVII, No. 1, 1905, p. 263 (Japan: Unzen; Hongkong).—*Compsosoma quadrivirgatum* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, 1854, p. 301 (Japan).—*Elaphis quadrivirgatus* Guenther, Cat. Colubr. Sn. Brit. Mus., 1858, p. 94 (Japan).—Jan, Icon. Ophid., livr. 24, 1867, pl. I, fig. 1 (Japan).—Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 114 (Hakodadi; Tokyo; Nambu, NE. Hondo).—Okada, Cat. Vert. Japan, 1891, p. 68 (Tokyo; Hakone; Nii shima; Koze shima; Awaji; Suwo; Yezo).—*Elaphis quadrivirgata* Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 112 (Nagasaki); 1876, p. 379 (Yokohama).—Hilgendorf, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, 1876, p. 30 (Yezo; Tokyo).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, heft 46, 1891, p. 238 (Yezo).

1826. *Coluber vulneratus* Boie, Isis, 1826, p. 212 (type-locality, Japan; Blomhoff, collector).

1837. *Coluber virgatus* Temminck and Schlegel, Fauna Japon., Rept., Ophid., pl. I[a] (error; not of text).

1860. *Elaphis bilineatus* Hallowell, Proc. Phila. Acad., 1860, p. 497 (type-locality, Volcano Bay, Yezo; Doctor Morrow, collector).

1860. *Leptophidium dorsale* Hallowell, Proc. Phila. Acad., 1860, p. 498 (type-locality, Hakodate, Yezo; Stimpson, collector).

1867. *Elaphis quadrivirgatus* var. *interrupta* Jan, Icon. Ophid., livr. 24, pl. I, fig. 2, cover p. 2 (type-locality, Japan; type in Mus. Milano).

1867. *Elaphis quadrivirgatus* var. *atra* Jan, Icon. Ophid., livr. 24, pl. I, fig. 3, cover p. 2 (type-locality, Japan; type in Mus. Milano).—*Coluber quadrivirgatus* var. *atra* Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 53 (Japan).

I have no doubt that *Leptophidium dorsale*, Hallowell is correctly referred here as a synonym. The type seems to be lost, but I have before me a young *E. quadrivirgata* from Yezo (U.S.N.M. No. 23435), which agrees with Hallowell's description in every particular, except in the number of ventrals (100, which of course is erroneous and probably a misprint for 200) and in the shape of the pupil which Hallowell says is "ovoid," but the latter statement is easily accounted for.

Description (figs. 279–281).—*Adult female;* U.S.N.M. No. 31819; Yamagawa, province of Satsuma, Kiusiu; June 14, 1903; Dr. Hugh M. Smith, collector. Rostral much broader than high, visible from above; internasals about as long as broad, smaller than prefrontals which are broadly in contact with supraocular; frontal as long as its distance from tip of snout and as the interparietal suture, broader in front than behind; parietals one-fourth longer than distance of frontal from tip of snout; nostril large, roundish between two subequal nasals; loreal squarish, about as high as long; one preocular, not in contact with frontal; one subpreocular; two postoculars; temporals 2+3; supralabials eight, fourth and fifth entering eye; five lower labials in contact with anterior chin-shields which are of the same length as the posterior; 19 rows of scales, the 11 median faintly, but distinctly keeled, the outer four on each side smooth; ventrals 203, obtusely angulate laterally; anal divided; 87

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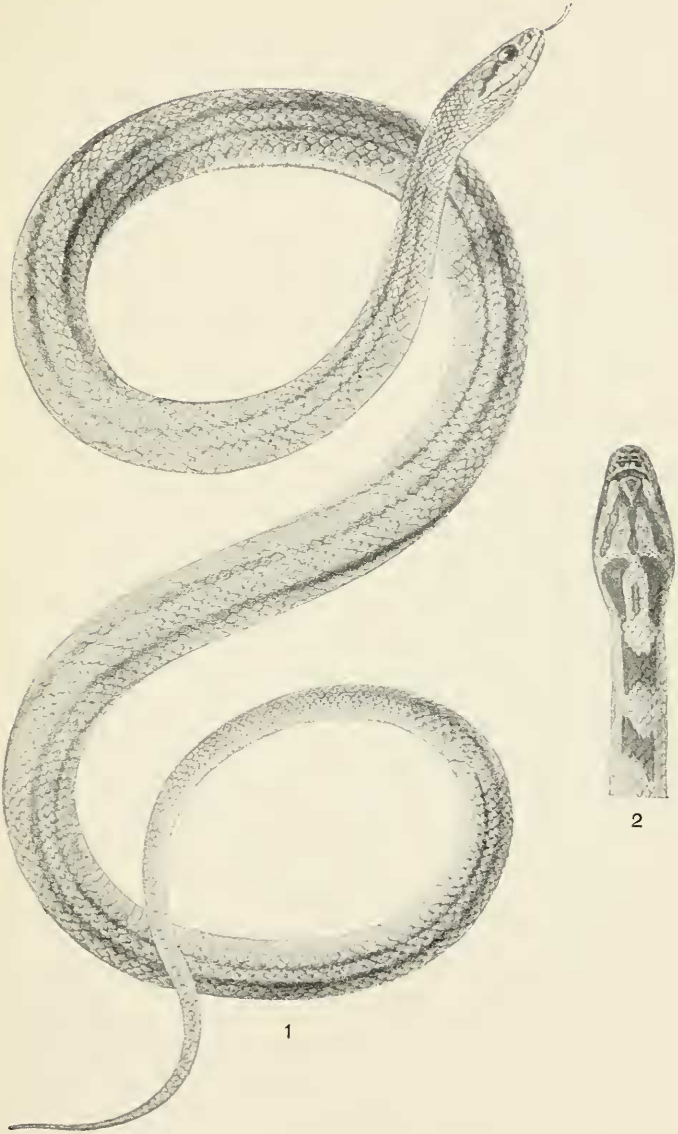
[a] Reproduced in this work on Plate XXI.

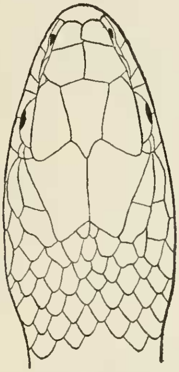


Elaphe quadrivirgata. (From Temminck and Schlegel.)

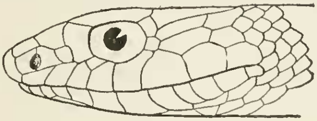
For explanation of plate see page 555.

pairs of subcaudals. Color (in alcohol) above tawny-olive, with four longitudinal, dark brown stripes, the outer ones involving the third and fourth scale rows, the middle ones the sixth and seventh scale rows; the lower stripes end at the vent, the upper ones continue on the tail to the tip; dark brown stripe from eye obliquely backward across the eighth supralabial and ending at the angle of the mouth; underside and lower half of supralabials light yellowish.

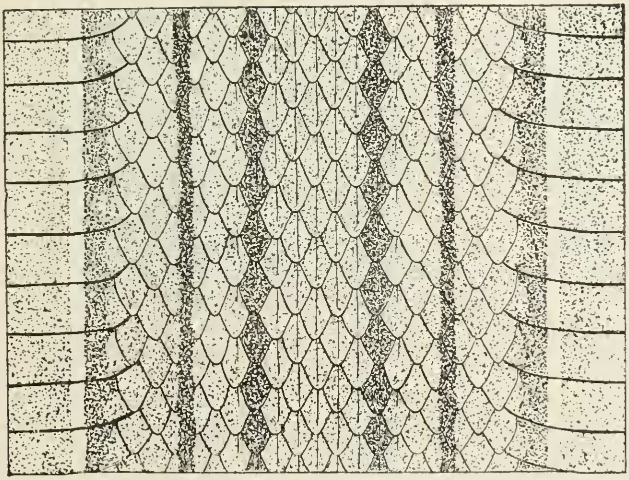
279



280



281



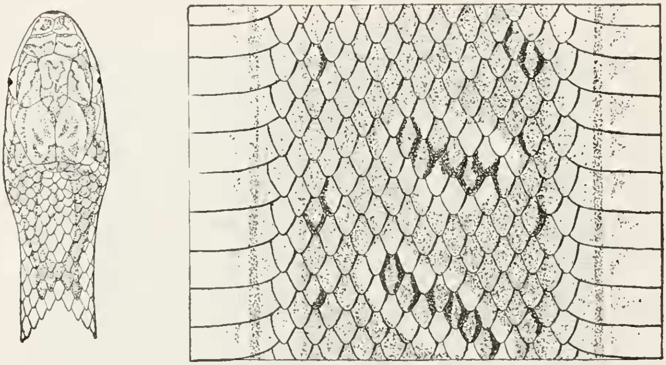
Figs. 279–281.—Elaphe quadrivirgata, adult. 1⅓ × nat. size. 279, top of head; 280, side of head; 281, color pattern around the middle of the body. No. 36548, U.S.N.M.

Dimensions.

	mm.
Total length	890
Snout to vent	695
Vent to tip of tail	195

The *young* may, or may not, have a coloration like that of the adult, a feature to be mentioned more in detail under the head of variation. When unlike the adult, as in Nos. 23435, from Yezo (figs. 282–283), and 34026, from Yokohama, the longitudinal stripes are absent, and instead there are numerous more or less complete narrow, dusky, transverse zigzag lines often with pale edges, or these cross lines are interrupted so as to form a lateral series of dots and a dorsal cross line, often quite oblique; on the posterior half of the upper surface of the head there is a brown, black-edged pattern somewhat resembling an ornate M, and anterior to this a semilunar band across prefrontals and supraoculars, as well as various marks of similar color on top and sides of the snout and on the supralabials; a brown black-edge postocular band crossing the last supralabial; ventrals faintly marked with brownish except on lateral angle which is visible as a whitish line.

Variation.—The number of scale rows and of supralabials seem to be absolutely constant in this species, and only two aberrations with regard to the latter are on record, namely, two specimens examined by Doctor Wall, who in one found on one side three supralabials entering the eye instead of two and in another 9 supralabials on one side, fifth and sixth touching the eye. An undivided anal occurs sometimes, and curiously enough it is found in no less than three specimens out of the five on record from Shikoku (Nos. 31876–31878). The subpreocular is also occasionally wanting, sometimes on both sides. Doctor Hilgendorf found three postoculars only once on one side, while several in our series show this anomaly, thus Nos. 23434 and 23435, while No. 4677 has them on both sides. The normal number of temporals is 2 + 2, but about 35 per cent of the specimens examined by me have 2 + 3, while I have only found 1 + 2 in three specimens, namely, Nos. 33978, 33979, and 34016. The number of ventrals varies between 193 and 215, subcaudals between 70 and 99.



282 283

FIGS. 282–283.—ELAPHE QUADRIVIRGATA, YOUNG. ENLARGED. 282, COLOR PATTERN OF TOP OF HEAD AND NECK; 283, COLOR PATTERN AROUND THE MIDDLE OF THE BODY. NO. 23435, U.S.N.M.

The coloration is very variable. In the first place, there are two distinct color phases, the normal pale one with the distinct four stripes, the other a melanistic phase, more or less uniform blackish brown with the stripes more or less obscured according to the darkness of the ground color. Of 45 specimens examined by me only six are melanistic, while in British Museum there is the same number in a total of 14 specimens. The black specimens are not confined to any one locality, but are found in all the islands, Yezo, Hondo, Shikoku, and Kiusiu, nor is this phase peculiar to the adults, as shown by No. 13754, which is quite young. In most of these black specimens, the labials, throat, anterior ventrals, and several longitudinal series of spots on the sides of the neck are more or less whitish.

In the pale, striped specimens there is also considerable variation. Thus the width of the stripes is not always the same, they being sometimes of equal width, sometimes the outer ones wider than the median ones, sometimes vice versa; sometimes the median stripes involve one row of scales only, the seventh, sometimes two, the sixth and seventh, or even three, viz, the eighth. The underside is also subject to great variation from nearly uniform whitish, or yellowish, to uniform slate-blue, with a distinct whitish line marking the lateral angle.

The most remarkable variation in coloration is probably that of the young, for while the majority appear to have a very distinct pattern of dusky dorsal cross lines and an ornate pattern on the head, as described above, others of exactly the same age are practically colored like the adults. Thus No. 34018, which shows as yet no longitudinal stripes, measures 413 mm. in total length, while the two striped young, Nos. 13754 and 34544, are respectively 375 and 378 mm. long. Of these the latter is pale and shows faint traces of a pattern on top of the head, sometimes also noticeable in larger specimens; the former is melanistic with a pale-brown underside.

Habitat.—This species seems to be confined to Japan proper. Numerous specimens are in the various museums from Kiusiu, Shikoku, Hondo, and Yezo. That it also occurs in the seven islands of Idzu is shown by a specimen from Nii shima in the Science College Museum, Tokyo (No. 92). Dr. Wall has recently recorded two specimens from the island of Yaku, south of Kiusiu.

A specimen in British Museum is said to have been collected by Mr. J. H. Leech at Gensan, Korea, but the locality is uncorroborated and highly suspicious. Mr. Leech also collected in Japan, and there is probably some error involved.[a]

Such is probably also the case with regard to a specimen in the Science College Museum, Tokyo (No. 8), said to have been collected by Mr. Tashiro in Okinawa shima. The occurrence of this snake in the Riu Kius is highly improbable.

Similar remarks apply to Doctor Slunin's specimen from Hongkong in the St. Petersburg Museum.

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[a] See p. 29, under *Hynobius leechii.* It should be noted, however, that Werner has recently referred an aberrantly colored specimen to this species, which Doctor Haberer is said to have collected at Hankow, China, and which is now in the collection of the Academy of Sciences in Munich. The unfortunate part is that Doctor Haberer also collected in Japan (Werner, Bayer, Akal., p. 383), and added two other Japanese snakes to the Chinese fauna (see *E. climacophora,* p. 326 and *conspicillata,* p. 336).

List of specimens of Elaphe quadrivirgata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U. S. N. M	4677	Male	Japan		Doctor Morrow	19	196	2	74	2+3	8
Do	13754	Young [a]	do		P. L. Jouy	19	207	2	95	2+2	8
Do	15418	Male	Oide, Shinshiu	Oct. —, 1882	do	19	205	2		2+3	8
Do	15419	do	Near Tokyo	Apr. 12, 1883	do	19	205	2	89	2+2	8
Do	23433	do	Yezo		[illegible] Tozawa	19	197	2	83	2+3	8
Do	23434	do.[b]	do		do	19	202	2	84	2+2—3	8
Do	23435	Young [c]	do		do	19	198	2	78	2+3	8
Do	31819	Female [d]	Yamagawa, Kinsiu	June 14, 1903	Dr. H. M. Smith	19	203	2	87	2+3	8
Do	31873	Male [b]	Kochi, Shikoku	May —, 1903	do	19	209	2	89	2+2	8
Do	31875	do.[b]	do	do	do	19	209	2	91	2+2	8
Do	31876	do	do	do	do	19	205	1	87	2+2	8
Do	31877	do	do	do	do	19	207	1	87	2+2	8
Do	31878	do	do	do	do	19	214	1	95	2+2	8
Do	33967	Female	Mount Fuji	Aug. —, 1898	A. Owston	19	200	2	78	2+3	8
Do	33968	do	do	do	do	19	207	2	87	2+2—3	8
Do	33969	Male	do	do	do	19	206	2	90	2+2	8
Do	33970	do	do	do	do	19	208	2	89	2+2—3	8
Do	33971	do	do	do	do	19	209	2	86	2+2	8
Do	33972	Female	do	do	do	19	209	2	85	2+2	8
Do	33973	Halfgr	do	do	do	19	201	2		2+2—3	8
Do	33974	do	do	do	do	19	202	2	87	2+2	8
Do	33975	Female	do	do	do	19	204	2	81	2+3	8
Do	33976	do	do	do	do	19	203	2	82	2+2	8
Do	33977	do	do	do	do	19	205	2	86	1+2	8
Do	33978	do	do	do	do	19	209	2	81	1+2	8
Do	33979	do	do	do	do	19	206	2	90	1+2	8
Do	33980	do	do	do	do	19	202	2	82	2+2	8
Do	33981	Halfgr	do	do	do	19	213	1	88	2+2	8
Do	34004	Female	Yokohama	Apr. —, 1903	do	19	203	2	84	2+2	8
Do	34005	Male	do	do	do	19	201	2	87	2+2	8

Do	34015	do.[b]	Suruga	do	do	19	208	2		2+2—3	8
Do	34016	Halfgr	Yokohama	Aug. —, 1898	do	19	204	2	86	1+2	8
Do	34017	Female	do	Nov. 2, 1902	do	19	203	2	83	2+2	8
Do	34018	Young	Mount Fuji	Aug. —, 1898	do	19	202	2	85	2+2	8
Do	34019	do	do	do	do	19	205	2	88	2+2—3	8
Do	34020	do	do	do	do	19	205	2	88	2+2—3	8
Do	34021	do	do	do	do	19	201	2	82	2+2	8
Do	34022	do	do	do	do	19	207	2	89	2+3	2
Do	34026	do	Suruga	Nov. —, 1903	do	19	205	2	81	2+2	8
Do	34048	Female [b]	Nagasaki	Aug. —, 1901	do	19	199	2	87	2+3	8
Do	34544	Young [e]	Isobe, near Yokohama	May 10, 1904	do	19	207	2	86	2+3	8
Do	36548	Male [f]	Tokyo		Sci. Coll. Tokyo	19	209	2	85	2+2	8
Do	36549	do.[f]	do		do	19	208	2		2+2	8
Do	36550	do.[g]	Nii shima, Idzu Islands		do	19	211	2	87	2+2	8
Sci. Coll. Tokyo	8	Male	[Okinawa shima?]		Tashiro	19	215	2	99	2+3	8
Mus. Leiden	396	([h])	Japan				208		90		
Brit. Mus	*a*	Male [i]	do		Leiden Mus	19	208	2	88		
Do	*b*	do.[i]	Yokohama		Challenger Exped	19	204	2	81		
Do	*c*	do.[i]	do		do	19	204	2	84		
Do	*d*	Female [i]	do		do	19	200	2	70		
Do	*e*	Young [i]	Nikko		C. Maries	19	209	2	80		
Do	*f*	do.[i]	do		do	19	200	1	87		
Do	*g*	do.[i]	Miyanoshta		J. H. Leech	19	195	2	80		
Do	*h*	Halfgr [i]	Satsuma		do	19	202	2	80		
Do	*k*	Female [j]	Japan		Leiden Mus	19	200	1	84		
Do	*l*	do.[j]	do		do	19	202	2	83		
Do	*m*	Male [j]	do		Zool. Soc	19	203	2	85		
Do	*n*	Young [j]	do		Sir R. Owen	19	203	2	83		
Do	*o*	do.[j]	Kumamoto		J. H. Leach	19	203	2	83		
Do	*p*	do.[j]	do		do	19	205	2	89		

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[a] Melanistic, p. 331.
[b] Melanistic.
[c] Fig. 282-283.
[d] Description, p. 328.
[e] P. 331.
[f] Sci. Coll. No. 72. Figs. 279-281.
[g] No subpreocular.
[h] Fauna Jap. Ophid., pl. 1.
[i] Boulenger, Cat. II, p. 60.
[j] Boulenger; melanistic.

ELAPHE CONSPICILLATA [a] (Boie).

DJIMEGURI.

1826. *Coluber conspicillatus* Boie, Isis, 1826, p. 211 (type-locality, Japan; Blomhoff, collector); Bijdr. Natuurk. Wetensch., II, Pt. 1, 1827, p. 262.—Schlegel, Phys. Serp., 1837, II, p. 171 (Japan).—Temminck and Schlegel, Fauna Japon. Rept., 1837, p. 85; Ophid, pl. iii (Japan).—Hilgendorf, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, 1876, p. 30 (Tokyo).—Fritze, Mitth. Deutsch. Ges. Ost-Asiens, V, heft 46, 1891, p. 239 (not seen in Yezo).—Boulenger, Cat. Sn. Brit. Mus., II, 1894, p. 51 (Yokohama; Nikko; Haruna Hills).—Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 52 Hondo).—Wall, Proc. Zool. Soc. London, 1903, p. 100 (Nagasaki); 1905, II, p. 513 (Hondo, Tanega Il.).—*Elaphis conspicillatus* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, 1854, p. 285 (southern islands of Japan).—Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 114 (Tokyo).—Okada, Cat. Vert. Japan, 1891, p. 68 (Tokyo; Osaka; Nikko).—*Elaphis conspicillata* Martens, Preuss. Exped. Ost-Asien, Zool., I, 1866, p. 112; 1876, p. 379 (Nagasaki).

1860. *Proterodon tessellatus* Hallowell, Proc. Phila. Acad., 1860, p. 499 (type-locality, Japan).—*Dinodon ? tessellatus* Boulenger, Cat. Sn. Brit. Mus., I, 1893, p. 364.

1878. *Coronella perspicillata* Mueller, Verhandl. Naturf. Ges. Basel, VI, Pt. 4, p. 595 (*lapsus*).

The specimen which served Hallowell for the type of the new genus and species *Proterodon tessellatus* was probably never entered in the catalogue of the National Museum, and seems to have been lost. Boulenger has referred it, with a query, to the genus *Dinodon*,[b] but I have no doubt that Hallowell described a fully adult *Elaphe conspicillata*, which he failed to recognize as such, because of the disappearance of the characteristic markings on head and back. Scale formula, coloration, and all, agree with *E. conspicillata*. Even the dental formula, as given by him, does not deviate so very far from what I find in my specimens, in which the posterior teeth are decidedly smaller than those preceding them.

Description (figs. 284–286).—*Adult male;* U.S.N.M. No. 34025; Mori, near Yokohama; October, 1902; Owston, collector. Rostral very much broader than high, visible from above; internasals squarish, broader than long, much shorter than prefrontals which are in contact with supraoculars; rostral as long as its distance from tip of snout, and longer than interparietal suture, twice as large as the rather narrow supraocular; parietals much longer than distance of frontal from tip of snout; nostril large, rounded, between two nasals, of which the posterior is considerably larger than anterior; loreal rather small, wider than high; one preocular not in contact with prefrontal; no subpreocular or subocular; two postoculars; temporals large,

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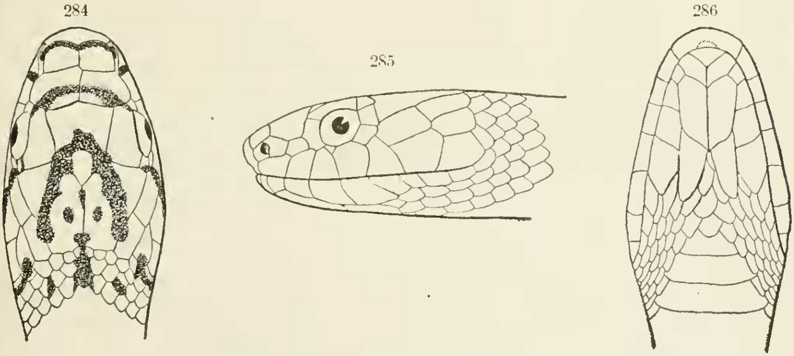
[a] Signifying spectacled, from *conspicilla*, medieval Latin for a pair of spectacles; referring to the black markings on the head of the young.

[b] Cat. Snakes Brit. Mus., I, 1893, p. 364.

1+2; supralabials 7, sixth largest, third and fourth entering orbit; four lower labials in contact with anterior chin-shields which are longer than posterior; 21 rows of scales, with feeble keels visible on the middle nine rows; 207 ventrals, scarcely angulate laterally; anal divided; 74 pairs of subcaudals. Color (in alcohol) above uniform drab-gray, the outer seven or eight scales with black bases and lateral margins, and a black spot on the upturned outer portion of every other or third ventral; head above with a few black marks, viz, an inverted V on the frontal and parietal region with a black line on the posterior third of the interparietal suture; three black dots on prefrontals; a black line on the internasals along the suture with the rostral; on the sides of head a black mark on suture between first and second supralabials and another under eye on suture between third and fourth supralabials, this mark coming to the lower lip on the suture between fourth and fifth lower labials; an oblique black line from postoculars to lip across the middle of the sixth (penultimate) supralabial; underside whitish checkered with bold black spots, underside of tail with a narrow, often interrupted, black zigzag line on the median suture.



FIGS. 284-286.—ELAPHE CONSPICILLATA. 2 × NAT. SIZE. 284, TOP OF HEAD, WITH COLOR PATTERN; 285 SIDE OF HEAD; 286, UNDERSIDE OF HEAD. NO. 36547, U.S.N.M.

Dimensions.

	mm.
Total length	771
Snout to vent	623
Vent to tip of tail	148

The *young*, as a rule, have a much more distinct color pattern, such as No. 6164, consisting of narrow, black, white-edged dorsal cross bands alternating with vertical bars of the same width and color, sometimes divided into two rows of spots; the pattern on the head is much more distinct, and the black lines continuous, the most marked being the inverted V, a curved line on the prefrontals between the eyes, and the black band back of the upper outline of the rostral.

Variation.—There is not any great variation in the scutellation. The number of scale rows seems to be constant, 21 [a], and so is the absence of a true subpreocular (the anomalous scute figured in fig. 285 is really only an accidental subocular separated off on one side from the upper *posterior* corner of the third supralabial). Temporals are also nearly always 1+2, though Boulenger mentions the occurrence of 2+2. In one of our specimens the anal is undivided; ventrals vary between 200 and 227, subcaudals between 60 and 76. In two specimens there are eight supralabials on one side, in one six. One specimen, No. 34011, is abnormal in lacking the loreal on one side.

In the young there is some apparent variation in the color due to the fact that the strongly marked first color pattern gradually gives way to the uniform tint of the adults. Apparently some specimens retain the early pattern later than others; thus No. 31852, although 18 mm. longer than No. 34013, which has nothing left of the original pattern on the back but numerous irregular and scattered black dots, shows the young pattern in its least modified form. These remarks refer chiefly to the pattern on the back, because that of the head remains strong and plain long after the back has become uniform. Some of the head markings remain longer than others, especially the most characteristic ones, viz, the line crossing the penultimate supralabial, the two lines crossing the lips below the eye and between first and second supralabials, and the black postrostrál line.

Habitat.—Apparently confined to Japan, but not so common as *E. quadrivirgata* or *E. climacophora*, and comparatively few specimens with definite localities attached are in the museums. The Leiden Museum specimens collected by von Siebold and Buerger probably came from Kiusiu. The Stockholm Museum has a specimen (No. 536) from Nagasaki, collected by Dr. O. Nordquist. The Berlin Museum has it from Nagasaki and Tokyo, and British Museum from Yokohama, Nikko, and the Haruna Hills. Dr. Wall has recently received a specimen from Tanega shima, south of Kiusiu. Our museum, finally, has it from Tokyo, from Oide, Shinshiu, where Jouy collected it in 1882, and from Mount Fuji. Dr. Hugh M. Smith collected it in Shikoku. The only observation as to the altitude attained by this species in the mountains is furnished with a specimen in British Museum, which Lord Dormer collected in the Haruna Hills, 2,500 feet above the sea.

Giglioli and Salvadori record [b] a young specimen as *Callopeltis conspicillatus* taken by the "Vettor Pisani" expedition at the Avahuna River, Olga Bay, Russian Coast Province, during September, 1879.

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[a] A specimen in the Munich Museum said to have been collected at Hankow, China, by Doctor Haberer, is recently reported by Doctor Werner (Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904. p. 357) as having 23 scale rows. Altogether it is a very dubious record (see pp. 326, 331).

[b] Proc. Zool. Soc. London, 1887, p. 595.

Until further details relative to this specimen be obtained it is permissible to suspect that a mistake in identification has been made, and that in reality it is an *E. schrenkii*. I must add, however, that there are several specimens in the Hamburg Museum (Nos. 849–852) collected by Doerries in the "Amurgebiet," which are identified there as *E. conspicillata*.

List of specimens of Elaphe conspicillata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M.	6164	Young	Japan			21	214	2	72	1+2	7-8
Do	15417	Male	Oide, Shinshiu	1882. Oct. —	P. L. Jouy	21	212	2	....	1+2	7
Do	31852	Half gr.[a]	Kochi, Toza, Shikoku.	1903. May —	Dr. H. M. Smith.	21	219	2	73	1+2	7
Do	34009	Female	Mount Fuji	1898. Aug. —	A. Owston	21	227	2	67	1+2	7
Do	34010	do	do	do	do	21	217	1	68	1+2	7
Do	34011	Male	do	do	do	21	211	2	67	1+2	6–7
Do	34012	Female	do	do	do	21	214	2	69	1+2	7–8
Do	34013	Half gr.[b]	do	do	do	21	206	2	63	1+2	7
Do	34025	Male[c]	Mori, near Yokohama.	1902. Oct. —	do	21	207	2	74	1+2	7
Do	36547	Young[d]	Tokyo		Sci. Coll., Tokyo	21	207	2	68	1+2	7
		Adult[e]	Japan			21	211	2	73	1+2	8?
Brit. Mus.	*a*	Male[f]	do		Leiden Mus	21	219	2	67	....	....
Do	*b*	Young[f]	do		do	21	217	2	66	....	....
Do	*c*	Male[f]	Yokohama		Challenger Exped.	21	215	2	67	....	....
Do	*d*	Young[f]	Nikko		do	21	224	2	63	....	....
Do	*e*	do.[f]	Haruna Hills, 2,500 feet.		Lord Dormer	21	206	2	68	....	....

[a] Length 488 mm.

[b] Length 470 mm.

[c] Description, p. 334.

[d] Figs. 284-286; Sci. Coll. No. 71.

[e] Hallowell; type of *Proterodon tessellatus*.

[f] Boulenger, Cat. II, p. 52.

Genus LIOPELTIS[a] Fitzinger.

1843. *Liopeltis* Fitzinger, Syst. Rept., p. 26 (type, *Herpetodryas tricolor* Schlegel).
1860. *Eurypholis* Hallowell, Proc. Phila. Acad., 1860, p. 493 (type, *E. semicarinatus*).
1862. *Phragmitophis* Guenther, Ann. Mag. Nat. Hist. (3), IX, p. 126 (type, *Cyclophis tricolor*).
1895. *Entechinus* Cope, Proc. Phila. Acad., 1894, p. 427 (type, *Cyclophis major*).
1900. *Entacanthus* Cope, Rep. U. S. Nat. Mus., 1898, p. 780 (type, *Cyclophis major*).

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[a] From λεῖος, smooth; πέλτη, a little shield; scale.

Liopeltis is almost coextensive with Boulenger's *Ablabes* (part of *Ablabes* Duméril and Bibron, 1854) for which he selected *A. baliodeirus* as the type (=*Gongylosoma* Fitzinger, 1843), with the exception of the latter species, which Cope says has hypapophyses present throughout the vertebral column. The species are very difficult to distinguish generically from *Elaphe*, the chief character being the absence of apical pits to the dorsal scales. These are very obscure in some of the *Elaphe*, for instance *E. rufodorsata*, and can only be discovered by a very careful examination of the dry scale. This latter species, therefore, has been referred repeatedly to the genus here treated of.

This genus is mostly oriental in its distribution, extending in the west to the Himalayas and in the south to the Malayan Islands. In China it does not reach farther north than Shanghai and is also unknown in Japan proper. The Chinese species extends, however, to Formosa, and there are two species apparently peculiar to the Riukius.

KEY TO THE RIUKIU AND FORMOSA SPECIES OF LIOPELTIS.

a^1. Scale rows 15.
  b^1. Posterior chin-shields much shorter than the anterior.......... *L. major*, p. 338.
  b^2. Posterior and anterior chin-shields subequal........... *L. semicarinata*, p. 340.
a^2. Scale rows 17 .... *L. herminæ* p. 343.

LIOPELTIS MAJOR [a] (Guenther).

1858. *Cyclophis major* Guenther, Cat. Colubr. Snakes Brit. Mus., p. 120 (type-locality, near Ningpo, China; type in Brit. Mus.); Rept. Brit. India, 1864, p. 230 (Ningpo; Hongkong) pl. XVII, fig. *L;* Ann. Mag. Nat. Hist. (6), I, 1888, p. 170 (near Kiukiang, China).—*Ablabes major* Boettger, Ber. Senckenberg. Naturf. Ges., 1894, p. 140 (Lueshan Mts., Kiukiang).—Boulenger, Cat. Snakes Brit. Mus., II, 1894, p. 279 (eastern China; Formosa); Proc. Zool. Soc. London., 1899, p. 165 (Prov. of Fokien).—Wall, Proc. Zool. Soc. London, 1903, p. 93 (Hongkong; Formosa).

1860. *Herpetodryas chloris* Hallowell, Proc. Phila. Acad., 1860, p. 503 (type-locality, Hongkong; type, U.S.N.M. No. 7335; Brooke, collector).

Description.—Half grown male; U.S.N.M. No. 7335; type of *Herpetodryas chloris* Hallowell; Hongkong Island, China; May, 1854; Mr. Brooke, collector (figs. 287–289). Rostral somewhat broader than high, visible from above; internasals very small, much smaller than prefrontals, which are broadly in contact with supraocular; frontal much longer than its distance from tip of snout, equalling the interparietal suture, slightly wider in front than behind, wider than supraoculars; parietals long, twice as long as the frontal's distance from rostral, followed by two enlarged scales or scutes, which are larger than internasals; nostril large, oval, in the anterior portion of an elongated nasal; loreal much longer than high, about the same length as nasal but lower; one preocular widely separated from frontal; two postoculars, upper largest; temporals 1+2, large, with straight edges; 8 supralabials, fourth and fifth entering eye, seventh largest, sixth nearly triangular; four lower labials in contact with anterior chin-shields, which are longer than posterior; 15 rows of smooth scales; 163 ventrals, not angulate laterally; anal divided; 86 pairs of subcaudals. Color (in alcohol) above blue, in life bright green; under side white or, in life, yellow.

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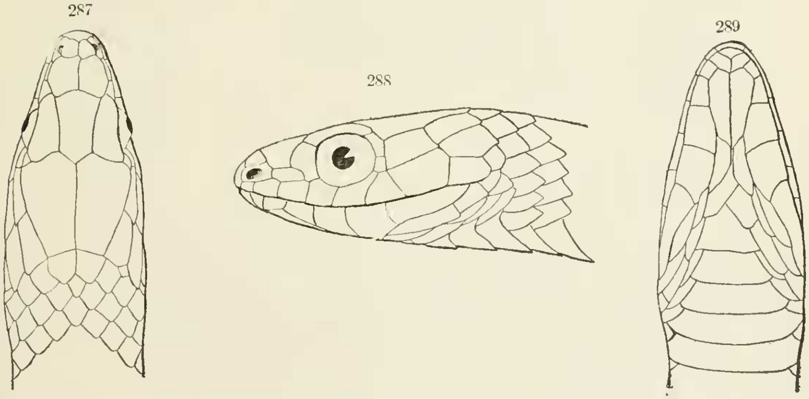
[a] Signifying larger; rather large.

Dimensions.

	mm.
Total length	684
Snout to vent	506
Vent to tip of tail	178

A *young* specimen from the province of Fokien, China, is described by Boulenger[a] as having irregular black transverse spots on the nape and anterior part of the back, and traces of an interrupted black lateral streak.



FIGS. 287-289.—LIOPELTIS MAJOR. 2 × NAT. SIZE. 287, TOP OF HEAD; 288, SIDE OF HEAD; 289 UNDERSIDE OF HEAD. NO. 7335, U.S.N.M.

Variation.—Boulenger describes this species as having a divided nasal, but I can not make out any such division in our specimen. Doctor Wall mentions a specimen having seven labials, with the third and fourth touching the eye on one side. Ventrals range between 163 and 177; subcaudals between 70 and 90.

Habitat.—Apparently restricted to the lower Yangtse Valley and coasts of eastern China, between Hongkong and Shanghai, as well as to Formosa, from which island Swinhoe brought four specimens to British Museum. Doctor Wall saw two additional specimens from Formosa in the Hongkong City Hall Museum. In the Chinese province of Fokien it has been found as high as 3,000 to 4,000 feet altitude.

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[a] Proc. Zool. Soc. London, 1899, p. 165.

List of specimens of Liopeltis major.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
				1854.							
U.S.N.M	7335	Male[a]	Hongkong Island	May —	Brooke	15	163	2	86	1+2	8
Brit. Mus.	*f*	Female[b]	Formosa		R. Swinhoe	15	170	2	86	....	....
Do	*g*	do.[b]	do		do	15	168	2	86	....	....
Do	*h*	do.[b]	do		do	15	176	2	85	....	....
Do	*i*	do.[b]	do		do	15	171	2	83	....	....

[a] Description, p. 338; figs. 287–289. Type of *H. chloris*. [b] Boulenger, Cat. II, p. 279.

LIOPELTIS SEMICARINATA[a] (Hallowell).

1860. *Eurypholis semicarinatus* Hallowell, Proc. Phila. Acad., 1860, p. 493 (type-locality, Nafa, Okinawa shima, Riu Kiu; types, U. S. Nat. Mus., No. 7316; Wright, collector).—*Ablabes semicarinatus* Boulenger, Proc. Zool. Soc. London, 1887, p. 148 ("Loochoo Islands," Pryer, collector); Cat. Sn. Brit. Mus., II, 1894, p. 278 (Great Loochoo Island; Holst, collector; Nagasaki!).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 862; author's separate, p. 13 (Okinawa shima), p. 864; author's separate, p. 15 (Amami-o-shima).—Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 115 (Miyakoshima, Yaeyama group); Kat. Schl. Mus. Senckenberg., 1898, p. 78.—Wall, Proc. Zool. Soc., London, 1903, p. 101 (Japan; Loo Choos); 1905, II, p. 515 (Okinawa; Amami).

1868. *Cyclophis nebulosus* Guenther, Ann. Mag. Nat. Hist. (4), I, p. 418, pl. XIX, fig. *c* (type-locality, Nagasaki!; type in Brit. Mus.; Whitely, collector).

The two specimens which served Hallowell as types for this species are still in the United States National Museum (No. 7316) in a fair state of preservation. The scale formulas, as given by him and as counted by me, agree pretty well, but his dimensions do not. He says: Total length, 1 foot $7\frac{3}{4}$ inches; of tail, 4 inches, five lines [Pied du Roi], the equivalents in mm being about 536 and 118. The two specimens, as measured by Mr. Paine, my assistant, are: Total length, 492 and 564 mm.; tail, 107 and 122 mm., a considerable discrepancy. The means of the two specimens, however, viz, 528 and 115, are so near Hallowell's figures that it may be regarded as certain that the latter are not intended to represent the dimensions of the individual snake.

An examination of the type of Guenther's *Cyclophis nebulosus*, which I was permitted to make in 1898, fully confirms Boulenger's view that it is only the young of the present species. The young specimen collected by Holst in Okinawa shima has the frontal shield considerably larger than Guenther's type, but is otherwise indistinguishable, and a young specimen from Miyakoshima of the Saki shima group now before me and described below is also similar. The alleged habitat of the type of *C. nebulosus*, which is said to have been "obtained by Mr. Whitely at Nagasaki" is undoubtedly erroneous, and it is almost certain that all the birds and reptiles recorded as obtained by him at that place were not actually collected there. They are of much more southern origin, most probably from some group of the Riu Kius.

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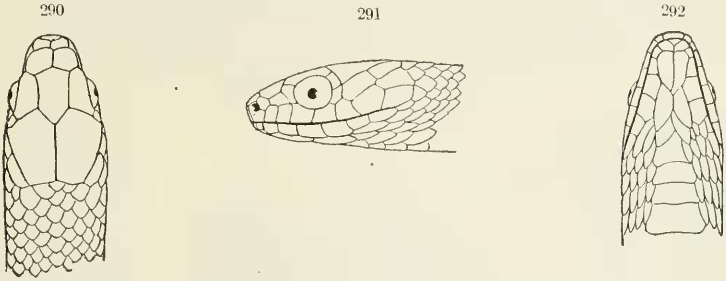
[a] Signifying half-keeled, the scales of the body being only keeled in their anterior half.

Description.—*Young*—Science College Museum, Tokyo, Japan, No. 15; Miyakoshima, Saki shima group; figs. 290–292. Rostral about as broad as high, visible from above; internasals very small, the suture between them less than one-half the suture between the prefrontals; frontal much longer than its distance from the tip of the snout and equally suture between parietals; nostril large, extending nearly the entire height of the nasal; loreal trapezoidal higher behind, slightly longer than high; one preocular not in contact with frontal; two postoculars; temporals 1 + 2, large; eight supralabials, seventh and eighth largest, sixth rather smaller than fifth, fourth and fifth entering eye; four lower labials in contact with anterior chin-shields, which are as long as the posterior; 15 scale rows, median nine rows with a slight indication of keel at the base, outer three on each side smooth, all without apical pits; ventrals, 189; anal divided; subcaudals, 80 pairs. Color (in alcohol) above olive gray, with numerous obscure "nebulous" spots of dusky on the anterior third of body posteriorly grading into two indistinct dark longitudinal lines on each side, including a paler band about two scales wide, a dusky narrow line frequently interrupted marking the boundary between scales and ventrals; top and sides of head, except labials, uniform olive gray with a minute black spot on each parietal near the middle of the suture between them; entire lower surface and supralabials uniform whitish, the last two with posterior margins blackish.



Figs. 290–292.—Liopeltis semicarinata. 2 × nat. size. 290, top of head; 291, side of head; 292, underside of head. No. 15, Sci. Coll. Tokyo.

Dimensions.

	mm.
Total length	285
Snout to vent	225
Vent to tip of tail	60

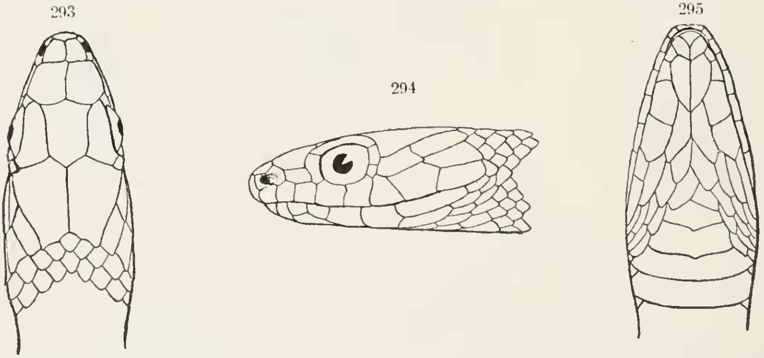
The *adult* male (U.S.N.M., No. 7316*a*; type; Naha, Okinawa shima; November, 1854; Wright, collector, figs. 293–295) is in all essential features of scutellation like the one described above, except that the snout is proportionally more elongated, with resulting longer internasals and longer loreal. The coloration is more uniform above, with faint indications of longitudinal dusky streaking, which is very marked on the side of the neck as interrupted longitudinal black streaks; last two supralabials marked as in the young.

Dimensions.

	mm.
Total length	492
Snout to vent	385
Vent to tip of tail	107

This snake grows to be more than 800 mm. long.

Variation.—Variation both as to scutellation and coloration is rather slight in this species. The most noteworthy abnormality is presented by U.S.N.M., No. 11127, which has the fifth supralabial on both sides divided by a horizontal suture so as to cut off a large posterior subocular. The number of scale rows, oculars, temporals, and supralabials seems to be absolutely constant, the ventrals and subcaudals vary between narrow limits. The greatest deviation from the normal is shown by the type of *C. nebulosus*, which is said to have only 174 ventrals, while in the other recorded specimens this number oscillates between 185 and 192; the subcaudals vary from 70 to 82.



Figs. 293–295.—Liopeltis semicarinata. 2 × nat. size. 293, top of head; 294, side of head; 295, underside of head. No. 7316*a*, U.S.N.M.

The most aberrant coloration is shown by one of five large individuals in the Science College Museum, Tokyo. It has four very distinct brown longitudinal stripes on the whole length of the body from nape to vent, while the upper two stripes continue to the end of the tail. These specimens were collected by Mr. Tashiro in Okinawa shima.

Habitat.—Restricted to the Riu Kiu Archipelago. The types were collected during the Rodgers North Pacific Exploring Expedition at

Naha, Okinawa shima, from which island there are now specimens in various museums, thus in Science College Museum, Tokyo, and in the Imperial Museum (Ueno Park), Tokyo, British Museum, and Hamburg Museum (No. 1491), and Doctor Fritze states that it is not rare there in summer. That it also occurs in the southern group is shown by a Science College specimen (No. 15) and two in Museum Senckenbergianum, all from Miyakoshima. Finally, Doctor Fritze enumerates it as one of the species occurring in Amami-ō-shima of the northern group, a statement possibly based upon specimens collected by Doctor Doederlein. Doctor Wall also records three specimens from this island as having been secured by Owston's collectors.

Its alleged occurrence in Japan proper is entirely unsupported. Whitely's specimen, upon which Guenther founded his *Cyclopis nebulosus* is said to have been obtained in Nagasaki, but all his birds and reptiles credited to that locality most certainly came from some of the Riu Kiu Islands.[a]

List of specimens of Liopeltis semicarinata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Labials.
U.S.N.M	7316*a*	Male [a]	Near Naha, Okinawa shima.	1854. Nov. —	Wright	15	186	2	77	1+2	8
Do	7316*b*	Female [b]	do	do	do	15	190	2	78	1+2	8
Do	11127	Male [c]	"Japan"		Perry exped.	15	191	2		1+2	8
Do	36518	do. [d]	Okinawa shima		Tashiro	15	187	2		1+2	8
Sci. Coll., Tokyo.	15	Young [e]	Miyakoshima			15	189	2	80	1+2	8
Brit. Mus	*a*	Male [f]	"Loo Choo Islds"		Pryer collection	15	190	2	82	1+2	8
Do	*b*	do. [f]	do		do	15	190	2	76	1+2	8
Do	*c*	do. [f]	do	Nov. —	do	15	190	2		1+2	8
Do	*d*	Female [f]	do		do	15	192	2	70	1+2	8
Do	*e*	do. [f]	do		do	15	187	2	72	1+2	8
Do	*f*	Young [f]	Great Loo Choo I		Holst	15	185	2	76	1+2	8
Do	*g*	do. [g]	Nagasaki [?]		Whitely	15	174	2	74	1+2	8

[a] Type; description p. 342, figs. 293-295.
[b] Type.
[c] P. 343.
[d] Sci. Coll. No. 7.
[e] Description, p. 341, figs. 290-292.
[f] Boulenger, Cat. II, p. 279.
[g] Boulenger; type of *C. nebulosus*.

LIOPELTIS HERMINÆ [b] (Boettger).

1895. *Ablabes herminae* BOETTGER, Zool. Anz., XVIII, July 8, 1895, p. 269 (type-locality, Miyakoshima, Sake shima group, Riu Kius; type in Mus. Senckenberg.); Offenbach. Ver. Naturk. 33-36 Ber., 1895, p. 110 (Miyakoshima); Kat. Schl. Mus. Senckenberg., 1898, p. 78 (Miyakoshima).—BOULENGER, Cat. Sn. Brit. Mus., III, 1896, p. 643.—WALL, Proc. Zool. Soc. London, 1903, p. 101 (Loo Choos); 1905, II, p. 515 (Iriomote).

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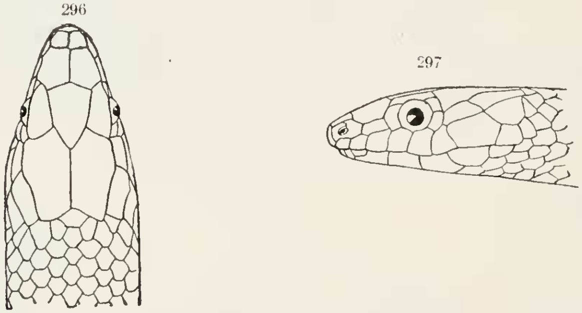
[a] See also Wall, Proc. Zool. Soc. London, 1905, II, p. 515, footnote.
[b] Named for —?

Description.—Adult male; U.S.N.M.No. 34014; Ishigaki shima, Riu Kiu Archipelago; June, 1899; Owston collection (figs. 296–297). Rostral as high as broad, just visible from above; internasals very small, much less than one-half the size of the prefrontals, which are broadly in contact with supraoculars; frontal as long as its distance from tip of snout and as interparietal suture, broader than supraoculars, considerably broader in front than behind; parietals broad, much longer than frontal; nostril large between two nasals, of which the posterior is much the larger; loreal, long and low, twice as long as high; one preocular widely separated from frontal; two postoculars; 1 + 2 large temporals; 8 supralabials, fourth and fifth entering eye, seventh largest, twice as high as eighth, which is very small, smaller than the temporal immediately above it; four lower labials in contact with anterior chin-shields which are longer than the posterior (on one side, shorter on the other); 17 rows of scales, which are smooth except on the posterior fourth of the body, where they show a faint keel at the base; 162 ventrals; anal divided; 52 pairs of subcaudals. Color (in alcohol) above, olive gray, each scale with an ill-defined median dusky spot near the tip, thus forming faint dusky longitudinal lines; underside whitish, some ventrals with a gray line along the base, and the subcaudals more or less mottled with gray; four median supralabials white, with dark gray sutures, the others olive-gray, like the top and sides of the head.



Figs. 296–297.—Liopeltis herminæ. $1\frac{1}{3}\times$ nat. size. 296, top of head; 297, side of head. No. 34014, U.S.N.M.

Dimensions.

	mm.
Total length	745
Snout to vent	610
Vent to tip of tail	135

Variation.—The only noteworthy deviation from the above description shown by the type specimen in the Senckenberg Museum is the two undivided subcaudals following the first two pairs; the ventrals are practically identical in number, while the subcaudals are slightly more numerous in the type; in the latter the subcaudals have a dark gray longitudinal stripe on each side. Doctor Wall in one specimen counts 47 subcaudals only, and in one he records 19 scale rows "in midbody; anteriorly and posteriorly the normal 17 scales were present." This specimen, from Iriomote shima, has 159 ventrals and 60 subcaudals.

Habitat.—Thus far only known from the Saki shima group, Riu Kiu Archipelago. Mr. B. Schmacker's Japanese collector obtained a single specimen in Miyakoshima. Two more specimens in Mr. Owston's collection were recorded by Doctor Wall, one of which is now in the United States National Museum. It was collected in Ishigaki shima, June, 1899. Another is now recorded by him from Iriomote shima.

List of specimens of Liopeltis herminæ.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M.....	34014	Male[a] ..	Ishigaki shima..	1899. June —	A. Owston	17	162	2	52	1+2	8
Senckenberg .	8277a	....do.[b] .	Miyakoshima ...	....	B. Schmacker .	17	163	2	60	1+2	8

[a] Description, p. 344; figs. 296–297.

[b] Type.

Genus PTYAS[a] Fitzinger.

1843. *Ptyas* Fitzinger, Syst. Rept., p. 26 (type, *Coluber blumenbachii=C. mucosus*).

1854. *Coryphodon* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, p. 180 (part).

The two species, in the East known as rat-snakes, may be easily distinguished thus:

a^1 Scale rows 17; scale rows a head length anterior to vent 14; ventrals more than 185 .... *P. mucosus*, p. 345.

a^2 Scale rows 15; scale rows a head length anterior to vent 11; ventrals less than 185 .... *P. korros*, p. 348.

PTYAS MUCOSUS[b] (Linnæus).

1758. *Coluber mucosus* Linnæus, Syst. Nat., 10 ed., I, p. 226 (type-locality, "in Indiis;" type in Roy. Mus. Stockholm); 12 ed., I, 1766, p. 388.—*Ptyas mucosus* Cope, Proc. Phila. Acad., 1860, p. 563.—Guenther, Rept. Brit. India, 1864, p. 249 (South-continental Asia; Formosa).—*Zamenis mucosus* Boulenger, Cat. Sn. Brit. Mus., I, 1893, p. 385 (south. Asia; Formosa).—Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 41 (Taiwan fu, Formosa).—Anderson, Bih. Svensk. Vet. Akad. Handl., XXIV, Pt. 4, no. 6, 1899, p. 25 (type).—Wall, Proc. Zool. Soc. London, 1903, p. 90 (Hongkong).

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[a] From πτυάς, a kind of snake, so named by the ancient Greeks from its hissing or spitting (πτύω).

[b] Signifying slimy.—The gender of *Ptyas* is feminine, but as Cope, and all the authors after him, have treated it as masculine, it is here so considered.

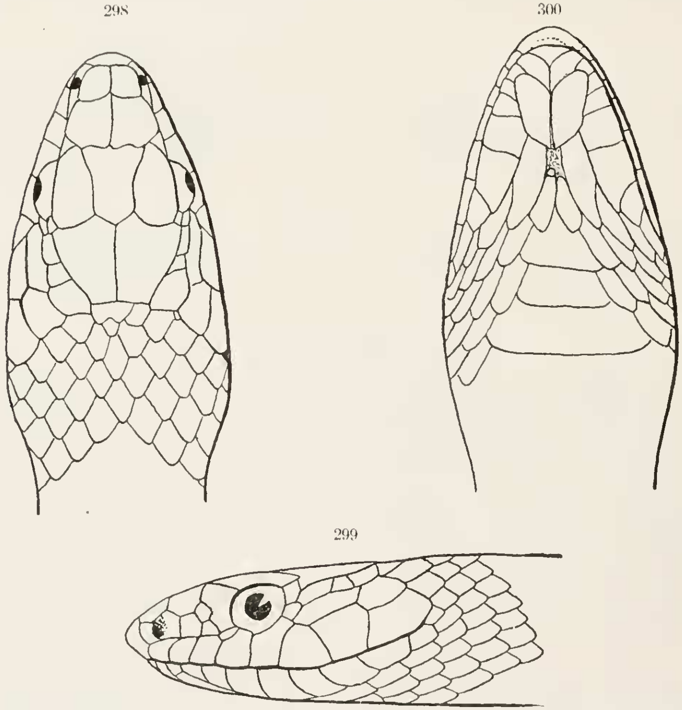
1820. *Coluber blumenbachii* Merrem, Syst. Amph., p. 119 (type-locality, Bengal).—*Coryphodon blumenbachi* Jan, Elenc. Ofid., 1863, p. 64 (Bengal; Ceylon; Japan); Icon. Ophid., livr. 24, 1867, pl. iii, figs. 2–3 (Ceylon; Bengal).

1839. *Coluber dhumna* Cantor, Proc. Zool. Soc. London, 1839, p. 51 (type-localities, Carnatic, Orissa, Bengal, Nepal, Assam, Arracan, Tenasserim).

1860. *Leptophis trifrenatus* Hallowell, Proc. Phila. Acad., 1860, p. 503 (type-locality, Hongkong; type, U.S.N.M., No. 7510).

1867. *Coryphodon blumenbachi* var. *carinata* Jan, Icon. Ophid., livr. 24, pl. iii, fig. 4 (type-locality, "Japan;" type in Mus. Genova) (not *C. carinatus* Guenther, 1858).

Description.—*Adult male;* U.S.N.M. No. 7510, type of *Leptophis trifrenatus;* island of Hongkong; April, 1854; Lieutenant Brooke, collector (figs. 298–300). Rostral broader than high, somewhat projecting; internasals as long as broad, much smaller than prefrontals, which are in contact with supraocular; frontal as long as its distance from rostral and as the interparietal suture, much broader in front than behind, the lateral edges distinctly concave; supraocular large, as wide as the frontal at its lateral convexity; parietals broad, as long as the distance of frontal from tip of snout; nostril large, vertically elliptic between two subequal nasals; three loreals, one larger anterior followed by two smaller, one above the other; one preocular not in contact with frontal; a subpreocular; eye rather large, its diameter



Figs. 298–300.—Ptyas mucosus (type of trifrenatus). Nat. size. 298, top of head; 299, side of head; 300, underside of head. No. 7510, U.S.N.M.

equaling its distance from nostril; two postoculars; 2+2 temporals; eight supralabials, seventh and eighth largest, fourth and fifth entering eye, fifth narrow and high, in contact with lower postocular and lower anterior temporal; five lower labials in contact with anterior chin-shields which are shorter than the posterior; one pair of postgeneials; 17 rows of scales, the middle three of which are feebly keeled, the others quite smooth; 190 ventrals; anal divided; 111 pairs of subcaudals. Color (in alcohol) tawny with irregular narrow cross lines of black which is confined to the edges and tips of the scales; head above uniform, sides paler, labials and temporals edged behind with brownish black; underside whitish, the ventrals marked with a narrow brownish line at the posterior margin, becoming darker and broader behind, and in addition every fifth ventral has on each side a sharply defined, narrow dark brown bar along the base or anterior margin.

Dimensions.

	mm.
Total length	1,665
Snout to vent	1,250
Vent to tip of tail	415

The *young* are said to have usually light cross bands on the front half of the body.

Variation.—Ventrals are recorded as varying between 187 and 208, subcaudals between 95 and 140. The number of loreals is somewhat variable, and Doctor Wall records one specimen with nine supralabials on one side, fifth and sixth touching the eye.

This species grows to be more than 2 meters long.

Habitat.—The rat-snake has a wide distribution over the entire southern continental Asia. In the Himalayas it is found at an altitude of over 5,000 feet. In southeastern China it occurs from Hainan to Chusan. Swinhoe collected two specimens in Formosa, where, according to Guenther, the species is not rare. These specimens are in British Museum. A third specimen, from Taiwan fu, South Formosa, was sent by Mr. Schmacker to the Senckenberg Museum.

The locality of the specimen in the Genova Museum, upon which Jan based his variety *carinata* and which is said to have come from Japan, is undoubtedly erroneous.

List of specimens of Ptyas mucosus.

U. S. N. M. No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
7510	Male [a]	Hongkong, China	Apr. 1854.	Lieutenant Brooke	17	190	2	111	2+2	8

[a] Type of Hallowell's *Leptophis trifrenatus*. Description, p. 346, figs. 298–300.

PTYAS KORROS[a] (Schlegel).

1837. *Coluber korros* SCHLEGEL, Phys. Serp., II, p. 139 (type-locality, Java; types in Leiden Mus.; Reinwardt, collector); Abbild. Amph., 1839, p. 99, pl. XXVII; pl. XXVIII, figs. 1-6.—*Coryphodon korros* JAN, Icon. Ophid., livr. 24, 1867, pl. IV, fig. 2 (Oude, India).—*Ptyas korros* COPE, Proc. Phila. Acad., 1860, p. 563 (Siam).—STEINDACHNER, Novara Exped., Zool., I, Rept., 1867, p. 65 (Amoy).—*Zamenis korros* BOULENGER, Fauna Brit. India, Rept., 1890, p. 324; Cat. Sn. Brit. Mus., I, 1893, p. 384 (Himalayas to Southern China, Malay Peninsula, Sumatra, and Java).—WALL, Proc. Zool. Soc. London, 1903, p. 90 (Hongkong; Formosa).

1837. *Coluber cancellatus* OPPEL in Schlegel's Phys. Serp., II, p. 139 (specimen label in Paris Museum).

Description.—Adult: U.S.N.M. No. 26233; Trong, Lower Siam, Malay Peninsula; Dr. W. L. Abbott, collector. Rostral slightly broader than high, visible to a considerable extent from above; internasals slightly broader than long, smaller than prefrontals, which do not quite touch the supraoculars; frontal longer than its distance from rostral, and longer than the interparietal suture, much broader in front than behind, the lateral outline quite concave; supraoculars narrower than frontal at its narrowest point; parietals broad and truncate behind, their length equaling the distance of the frontal from tip of snout; nostril large, vertically elliptic, between two nasals, the anterior of which is slightly larger; two loreals, the anterior largest, as high as long, in contact with preocular above the posterior loreal, which is rather small; one preocular, barely in touch with frontal; one subpreocular; eye large, its diameter equaling its distance from center of nostril; two postoculars; 2+2 temporals; eight supralabials, seventh largest, fourth and fifth entering eye, fifth not in contact with temporal; five lower labials in touch with anterior chinshields, which are shorter than the posterior; 15 rows of smooth scales; 161 ventrals; anal divided; 140 pairs of subcaudals. Color (in alcohol) above anteriorly olive, each scale with a faint submarginal dusky line, on the posterior half of the body becoming gradually tawny olive, the dark lines becoming marginal and black; no distinct marks on head; sides of snout and six anterior supralabials pinkish buff; whole underside uniformly whitish suffused with pinkish buff.

Dimensions.—The specimen described is a skin in alcohol, the total length measuring about 1,210 mm.

Boulenger measures one specimen in British Museum as follows: Total length, 1,500 mm.; tail, 600 mm.

The *young* are said to have transverse series of pearl-colored spots forming cross bands.

Variation.—The number of loreals is commonly two or three, but Doctor Wall reports one Chinese specimen having only one loreal on both sides. The number of ventrals varies between 161 and 177, the subcaudals between 122 and 145. Doctor Wall gives the latter as 110–116, but some error seems to be involved in this statement, as our five specimens from the Malay Peninsula corroborate Boulenger's figures, there being from 133 to 140 subcaudals. In our six specimens the preocular touches the frontal in only one specimen, namely, the one described above, in all the others the prefrontals and supraoculars are in decided contact.

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[a] *Korros*, according to Schlegel himself, is the Javanese name for another snake (*Elaphe melanurus*), and was wrongly applied by him to the present species.

Habitat.—This snake belongs to the group of species which extend from the eastern Himalayas eastward through southern China, in this case at least as far north as Amoy, and southward through the Malay Peninsula to Sumatra and Java.

It is admitted to the fauna of Formosa on the strength of a specimen stated by Doctor Wall to be in the Hongkong City Hall Museum. The records of this collection, as explained by him, can not now be trusted, and while it is true that no other collector has obtained it there, the general distribution of the species is such as to make its occurrence in Formosa probable.

List of specimens of Ptyas korros.

U. S. N. M. No.	Age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
26233	Adult [a]	Trong, Lower Siam		Dr. W. L. Abbott	15	161	2	140	2+2	8
22877	do	do		do	15	174	2	.....	2+2	8
22878	do	do		do	15	175	2	133	2+2	8
22879	do	do		do	15	174	2	138	2+2	8
22880	do	do		do	15	172	2	138	2+2	8
22953	do	do		do	15	168	2	137	2+2	8

[a] Description, p. 348.

Genus ZAMENIS[a] Wagler.

1830. *Zamenis* WAGLER, Nat. Syst. Amph., p. 188 (type, *Coluber viridiflavus*).
1843. *Eremiophis* FITZINGER, Syst. Rept., p. 25 (type, *C. trabalis*).
1843. *Hierophis* FITZINGER, Syst. Rept., p. 26 (type, *C. viridiflavus*).
1862. *Tyria* COPE, Proc. Phila. Acad., 1862, p. 338 (substitute for *Zamenis*) (not of FITZINGER, 1826).

ZAMENIS SPINALIS[b] (Peters).

1866. *Masticophis spinalis* PETERS, Mon. Ber. Berlin Akad. Wiss., 1866, p. 91 (type-locality, "Mexico;" type in Berlin Mus.).—MOELLENDORFF, Journ. N. China Br. R. Asiat. Soc. (n. s.), XI, 1877, p. 104 (Peking).—*Zamenis spinalis* GUENTHER, Ann. Mag. Nat. Hist. (4), IX, 1872, p. 22 (N. China).—

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[a] From ζαμενης, irascible.

[b] Signifying pertaining to the spine, or backbone, with reference to the yellow, black-edged vertebral line.

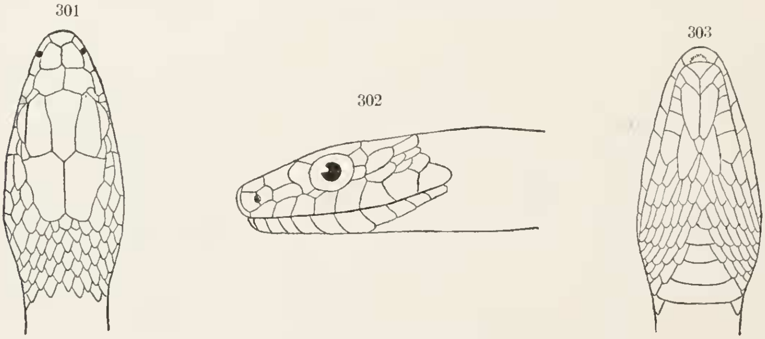
Strauch, in Przewalski's Mongoliya i Strana Tangutov, III, 1876, p. 46, pl. viii (Ala-shan Desert).—Mueller, Verh. Naturf. Ges. Basel, VII, Pt. 3, 1885, p. 681 (Mongolia).—Boulenger, Cat. Snakes Brit. Mus., I, 1893, p. 394 (Korea; north China; Hainan).—Wall, Proc. Zool. Soc. London, 1903, p. 91 (Yangtse Valley; Huangtsun, N. China).—Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 355 (Tsingtau, China).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1, 1905, p. 226 (Ala-shan; Ordos).

1866. *Zamenis bocourti* Jan, Nouv. Arch. Mus., Paris, II. 1866, Bull., p. 6 (type-locality, Siam; type in Paris Mus.; Bocourt, collector).

1867. *Zamenis cataphoranotus* Jan, Icon. Ophid., livr. 23, pl. ii, fig. 2 [a] (type-locality, Bangkok, Siam; type in Paris Mus.).

There being no specimen of this species in our collection, I give the following somewhat condensed account of the type specimen derived from Doctor Peters's original description.

Description (figs. 301–303).—*Adult*; Berlin Museum; type; "Mexico" (erroneously). Snout projecting, rounded; prefrontals broader than long, not longer than internasals; frontal very long, anteriorly broad and very obtusely angulate, the lateral outline forming a shallow concavity, posteriorly forming an acute angle with rounded apex; supraoculars anteriorly narrower than behind, where they are broader than the frontal at the same point; parietals scarcely longer than frontal, rounded behind; nostril between the upper part of the two nasals; loreal trapezoid, longer than high; preocular not in contact with frontal; one subpreocular; two postorbitals; temporals 2+2 on left side, 1+2 on right, the upper anterior temporal on this side being coalesced with the parietal; eight supralabials, fourth and fifth entering eye; five lower labials in contact with chin-shields, of which the posterior are slightly longer than the anterior; 17 rows of smooth scales; 203 ventrals; anal divided; 96 pairs of subcaudals. Color, above olive greenish brown; a yellow black-bordered longitudinal line beginning near the anterior end of the frontal along the middle of



Figs. 301–303.—Zamenis spinalis. Enlarged. 301, top of head; 302, side of head; 303, underside of head. From Jan, Icon. Ophid., liv. 23, pl. ii, fig. 2.

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[a] See this work, figs. 301–303.

the back nearly to the end of the tail, occupying the median dorsal scale row and the adjacent halves of the rows on either side; an indistinct cross band at the posterior edge of the prefrontals, preoculars and postoculars, an indistinct narrow longitudinal band on the temporals, the greater part of the supralabials and the whole underside yellow; on the upper part of the supralabials a black irregularly serrated band which is interrupted on the fifth supralabial and again appears, though narrower, on the posterior portion of the neck; a black spot anteriorly on the lateral angle of each ventral; an indistinct blackish line on the end of the ventrals and that part of the first scale row lying between them, the scales themselves white in the middle so as to form a pale longitudinal line above the black one.

Dimensions.

	mm.
Total length	835
Snout to vent	615
Vent to tip of tail	220

Variation.—This species seems to be subject to the usual variations, such as "preocular separated from or just touching the frontal," "temporals 1 + 2, 2 + 2, or 2 + 3." Boulenger says: "Eight (exceptionally nine) upper labials, fourth and fifth (or fifth and sixth) entering the eye," basing his diagnosis on four specimens, while Doctor Wall, who apparently examined 11 specimens, probably mostly from the Yangtse Valley, says that the normal arrangement is nine, with the fifth and sixth touching the eye, and that only two specimens had eight supralabials. He also mentions one specimen with two loreals, one behind the other, and one with the subpreocular absent on one side; two specimens had four lower labials in contact with anterior chin-shields on both sides. All his specimens had 2 + 2 temporals. With regard to the number of supralabials, it may be added that Doctor Werner in the two females, from Tsingtau, examined by him found eight. It is greatly to be regretted that the exact localities of the other specimens recorded have not been given with each individual scale formula. Minimum of ventrals recorded by Doctor Wall is 179; maximum by Doctor Werner is 211; subcaudals both minimum and maximum by Doctor Wall is 84 and 100.

Habitat.—This species was originally described as from Mexico, but it has since been discovered that its real habitat is eastern Asia, where it is recorded from Siam, the island of Hainan, the Yangtse Valley, and from northern China, Mongolia, and Korea. A specimen from the latter country is in British Museum.

List of specimens of Zamenis spinalis.

Museum.	No.	Sex.	Locality.	When collected.	By whom recorded.	Scale rows.	Ventrals.	Anal.	Caudals.
St. Petersb.			Ala-shan Desert		Strauch, l. c., p. 46	17	180	2	98
Berlin		[a]	"Mexico"		Peters	17	203	2	96
British	*a*	Female	Korea		Boulenger, Cat. I, p. 394.	17	198	2	85
Do.	*b*	Male	Near Peking		do	17	189	2	99
Do.	*c*	do	North China		do	17	192	2	90
Do.	*d*	do	Hainan		do	17	198	2	90
Munich		Female	Tsingtau		Werner, l. c.	17	210	2	90
Do.		do	do		do	17	211	2	91

[a] Type; description, p. 350.

Genus ZAOCYS[a] Cope.

1860. *Zaocys* Cope, Proc. Phila. Acad., 1860, p. 563 (type, *Z. dhumnades*).
1864. *Zapyrus* Guenther, Rept. Brit. India, p. 256 (type, *Z. fuscus*).
1891. *Zaoccys* W. L. Sclater, Journ. Asiat. Soc. Bengal, Nat. Hist., LX, p. 238 (error typogr.).

ZAOCYS DHUMNADES[b] (Cantor).

1842. *Coluber dhumnades* Cantor, Ann. Mag. Nat. Hist., IX, p. 483 (type-locality, Chusan, China; type in Brit. Mus.; Cantor, collector).—*Zaocys dhumnades* Cope, Proc. Phila. Acad., 1860, p. 563 (Ningpo).—Guenther, Rept. Brit. India, 1864, p. 256, pl. xxii, fig. a (Chusan; Ningpo).—Boulenger, Cat. Snakes Brit. Mus., I, 1893, p. 375, pl. xxvi, fig. 1 (Southern China).—Wall, Proc. Zool. Soc. London, 1903, p. 90 (Shanghai; Yangtse Valley).—Werner, Abh. Bayer. Akad. Wiss. (Murnchen), Klasse II, XXII, Pt. 2, 1904, pp. 357–364 (China), 372, footnote (Tamsui, Formosa).
1854. *Ablabes vittatus* Duméril and Bibron, Erpét. Gén., VII, Pt. 1, 1854, (p. 326) (type-locality, China; type in Paris Mus.; Montigny, collector).
1858. *Coryphodon carinatus* Guenther, Cat. Colubr. Snakes Brit. Mus., p. 112 (part: Chusan).

Having no specimen of this species for description, I submit the following diagnosis taken from Boulenger:[c]

Description.—Rostral broader than deep, visible from above; internasals shorter than the prefrontals; frontal once and one-fourth to once and a half as long as broad, as long as or a little shorter than its distance from the end of the snout, a little shorter than the parietals; loreal longer than deep; one preocular, with a subocular below it; two postoculars; temporals 2+2 or 2+1; eight upper labials, fourth and fifth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior; scales in 16 rows, the two median strongly keeled; a second dorsal pair may be feebly keeled; ventrals 187–194; anal divided; subcaudals 108–116. Color, anterior half of body olive above, with black edges to the scales and a yellow or orange, black-edged vertebral stripe; upper lip and belly yellow, the olive of the upper parts extending down to the ends of the ventrals; on the posterior part of the body the upper surfaces turn to black and the lower to dark olive or gray.

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[a] From ζα, a prefix meaning very; and ὠκύς, swift.

[b] Cantor gives no explanation of the name. Perhaps he meant to indicate a snake being like his *Coluber dhumna* (=*Ptyas mucosus*), the name of which in Hindu is said to be *dhamin*.

[c] Cat. Snakes Brit. Mus., III, p. 375.

Dimensions.	*mm.*
Total length	1,950
Snout to vent	1,420
Vent to tip of tail	530

Variation.—Doctor Werner has counted as many as 120 subcaudals in a Ningpo specimen and Doctor Wall as few as 96; the latter also gives 199 as maximum of ventrals observed by him. He also notes the following variations: Loreal, in one specimen two superposed shields on one side; temporals, a single anterior in one specimen on one side; anterior chin-shields in contact with four lower labials on both sides in one specimen.

Habitat.—Southern China, from Shanghai to Hongkong on the coast west to Lun-ngan-fu, province of Sze-chuen, in the interior.

Doctor Werner has recorded its occurrence in Formosa on the strength of a specimen in the Museum of the Munich Academy of Sciences, said to be from Tamsui.

Genus HOLARCHUS[a] Cope.

1854. *Simotes* DUMÉRIL and BIBRON, Erpét. Gén., VII, Pt. 1, p. 624 (type, *S. russelii* =*arnensis*) (not of Fischer, 1817).
1887. *Holarchus* COPE, Bull. U. S. Nat. Mus., No. 32, p. 54 (no species mentioned).
1893. *Dicraulax* COPE, Amer. Natural., 1893, p. 480 (type, *Holarchus trinotatus*= *Simotes purpurascens*.)

The generic name *Simotes*, by which the snakes of this genus have long been designated is preoccupied by *Simotes* of Fischer for a group of mammals as early as 1817. It has consequently to be replaced. Cope proposed *Holarchus*, in 1887, as a term for those species of the genus which have an undivided anal. It is not believed that this character alone, which moreover is not always constant, is sufficient ground for a division of the genus, and as *Holarchus* is the name next in date after *Simotes* it must stand for the combined genus.

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[a] From ὅλος, whole, undivided; ἀρχός, anus.

HOLARCHUS FORMOSANUS[a] (Guenther).

1863. *Simotes swinhonis* SWINHOE, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225 (*nomen nudum*; not of Guenther, 1864) (Tamsui, Formosa).

1872. *Simotes formosanus* GUENTHER, Ann. Mag. Nat. Hist. (4), IX, Jan. 1872, p. 20 (type-locality, Takao, Formosa; type in Brit. Mus.; Swinhoe, collector).—FISCHER, Abh. Naturw. Ver. Hamburg, IX, 1886, p. 12 (south Formosa; Oldenburg Mus.; Ruhstrat, collector).—MUELLER, Verh. Naturf. Ges. Basel, VIII, Pt. 2, 1887, p. 263 (south Formosa).—BOETTGER, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 129; Kat. Schl. Mus. Senckenberg., 1898, p. 73 (Hainan I., China).—BOULENGER, Cat. Sn. Brit. Mus., II, 1894, pp. 222, 359, pl. VIII, fig. 2 (Takao, Formosa; Swatow, China); III, 1896, p. 640 (central Formosa).—STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 221 (Taipa, Formosa).—SCHENKEL, Verh. Naturf. Ges. Basel, XIII, Pt. 1, 19—, p. 161.

1878. *Simotes bicatenatus* MUELLER, Verh. Naturf. Ges. Basel, VI, Pt. 4, 1878, p. 595 (Fumun, Prov. Kanton, not of Guenther).

1894. *Simotes hainanensis* BOETTGER, Ber. Senckenberg. Naturf. Ges., 1894, p. 133, pl. III, figs. 2*a–c* (type-locality, Hainan; type in Mus. Senckenberg.; Schmacker, collector).

Sauvage in 1877 has described a *Simotes* from China as *S. vaillanti.*[b] The chief points of difference seem to be the double anal and single preocular, but as these characters are not absolutely constant in *S. formosanus* it may possibly turn out to be the same species.

This species seems also closely allied to *H. violaceus* which occurs on the continent from Bengal to southern China, and which differs chiefly in having only 17 scale rows and fewer subcaudals. The two species appear to occur together in some localities, thus, for instance, in Hainan.[c]

Description.—Adult male; Science College Museum, Tokyo, No. 17A.; Taipa, Formosa; September, 1897; T. Tada, collector (figs. 304–306). Rostral higher than broad, projecting, turned over on top of the snout, the portion visible from above nearly as long as the internasal and prefrontal sutures; internasals oblique, much broader than long, smaller than prefrontals, which are in contact with supraocular; frontal very large, twice as broad as supraoculars, nearly as broad as long, longer than distance from tip of snout, and nearly as long as parietals, which are broad and truncate behind; nostril round, between two nostrils of which the anterior is much the larger; loreal higher than long; one preocular, not in contact with frontal; one subpreocular; two postoculars, the lower ones on both sides in this specimen abnormally coalesced with fifth supralabial; temporals 1+2, on right side an additional small anterior temporal; eight supralabials, all higher than long, the first three lower, the fourth suddenly higher, sixth, seventh, and eighth largest, fourth and fifth entering eye; three lower labials in contact with anterior chin-shields, which are much longer than posterior; 19 rows of perfectly smooth scales; 167 ventrals, strongly angulate laterally; anal undivided; 46 pairs of subcaudals. Color (in alcohol) above pale drab with numerous narrow and serrate chocolate-brown crossbars dissolved laterally into small spots; a somewhat indistinct longitudinal, median whitish stripe more or less interrupted by the dorsal crossbars; head above more clay-colored with a somewhat intricate symmetrical pattern of brown dark-edged figures which are again outlined by a light edge, viz, an inverted V on the nape with the apex on the interparietal suture; a median figure on frontal like an exclamation mark; an oblique band on each side across parietal, posterior temporals, and hind edge of last supralabial; a pale dark-edged line across anterior part of frontal and supraoculars through the eye to the upper lip, crossing the suture between fifth and sixth supralabials; an angular mark with apex toward the nostral on internasals and prefrontals; and a few dark marks on some of the supralabials; underside whitish shaded with pale drab toward the lateral ventral angle, which is thus marked off as a fairly distinct white line.

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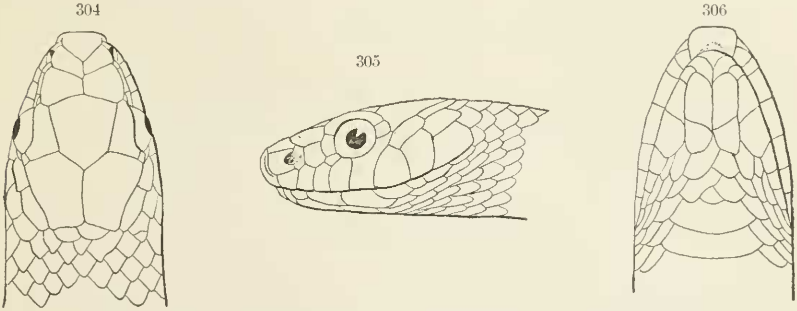
[a] From Formosa.

[b] Bull. Soc. Philom. Paris (7), I, p. 107.

[c] Cope's *Holarchus dolleyanus* (Proc. Phila. Acad., 1894 (publ. 1895), p. 423, pl. x, fig. 1), with 17 scale rows and 36 subcaudals, seems to belong to *Holarchus violaceus.*



FIGS. 301–306.—HOLARCHUS FORMOSANUS. 2 × NAT. SIZE. 304, TOP OF HEAD; 305, SIDE OF HEAD; 306, UNDERSIDE OF HEAD. NO. 17A, SCI. COLL. TOKYO.

Dimensions.

	mm.
Total length	557
Snout to vent	449
Vent to tip of tail	108

The *younger* specimens, for instance No. 34045, are much darker in coloration, the color above being dark drab with a rufous median dorsal line interrupted by very short, blackish crossbars; sides posteriorly nearly uniform, with a narrow dusky longitudinal line on the fourth scale row; markings on head essentially as in adults.

Variation.—Occasionally specimens are found with a divided anal.

The parietals in the three specimens examined by me show the curious characteristic of being in contact with the lower postocular behind the upper one, except on one side in two examples in which the outer part of the parietal is separated off so as to form a small abnormal upper temporal of the first row.

The ventrals, in twelve recorded specimens, vary between 162 and 173, the subcaudals between 46 and 55.

Habitat.—Originally described from the island of Formosa, where it has been recorded from Tamsui, Takao, Taipa, and now from Byoritsu, on the strength of a specimen in the U. S. National Museum recently acquired from Mr. A. Owston. It has since been found in the province of Kwangtung, southern China, and in the adjacent island of Hainan.

List of specimens of Holarchus formosanus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M	34045	Halfgr.	Byoritzu, Formosa	1903. May 25	A. Owston	19	167	1	46	1–2+2	7-8
Do	36509	Female.	Taipa, Formosa	1897. Sept. —	T. Tada	19	165	2	47	1+2	8
Sci. Coll., Tokyo.	17A	Male[a]	do	do	do	19	163	1	53	1–2+2	8

[a] Description, p. 354; figs. 304-306.

Genus DINODON[a] Duméril.

1853. *Dinodon* Duméril, Mém. Acad. Sci., Paris, XXIII (p. 463), author's separate, p. 67.—Duméril and Bibron, Erpét. Gén., VII, Pt. 1, p. 447 (type, *D. cancellatum*).
1860. *Eumesodon* Cope, Proc. Phila. Acad., 1860, p. 262 (type, *E. semicarinatus*).
1860. *Lepidocephalus* Hallowell, Proc. Phila. Acad., 1860, p. 498 (same type).
1893. *Dianodon* Cope, Amer. Natural., XXVII, May, 1893, p. 481 (emendation).

The genus *Dinodon* differs chiefly from *Ophites* Wagler[b] in the dentition, inasmuch as the former has a double interruption of the maxillary series, while in the latter only the anterior maxillaries are separated from the posterior series by a single interval.

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[a] From δις, double; νωδός, toothless; referring to the two toothless spaces in each upper jaw.

[b] This is the correct name for the genus which many authors, including Boulenger, call *Lycodon* Boie. The latter name appears first in Férrusac's Bulletin des Sciences Naturelles, 1826, p. 238, unaccompanied by any diagnosis, but embracing with certainty only three species then known, namely: "*Col. audax* Daud.—*C. Hebe* Daud.—*C. aulicus* Linn." One of these is the type. In the following year Boie's *diagnosis* of the genus was published in the Isis, 1827, p. 521, and the type is expressly given as *Col. audax*. This certainly fixes the name *Lycodon* beyond a doubt, and it will consequently take precedence over *Lycognathus* for the South American snakes of the latter genus. The name next in time for the Asiatic genus is *Ophites* Wagler (Syst. Amph., 1830, p. 186), which was based on the single species *L. subcinctus* Boie,

Ophites, which, according to what has been shown, is equivalent to *Lycodon*, as hitherto limited by Boulenger and others, is not represented with certainty within the territory covered by this work. However, reference must be made to two species which have been credited to it, namely, *Ophites albofuscus*, of which Guenther says[a] that it "occurs also in Formosa," the other being Mueller's "*Eumesodon carinatus* Cope (?)" from Japan.[b]

As to *Ophites albofuscus*, I have found no further corroborative evidence, and as this species seems to be confined to Sumatra and Borneo, Guenther's specimens probably belonged to some other species. It is then permissible to guess that he referred to the two specimens of *Dinodon septentrionale ruhstrati*, which Swinhoe sent from Formosa.

Mueller's "*Eumesodon carinatus* Cope (?),[c] Japan, juv." in the Basel Museum,[d] judging from his description of the dentition ("the second tooth and the one before the last are somewhat stouter and longer than the others") is not a "*Eumesodon*" (*Dinodon*) at all, but in all probability an *Ophites*. The description does not exactly tally with any of the known species, but comes probably nearest to *O. subcinctus*, from which it differs, however, in having smooth scales "except in the sacral region [Lendentheil], where there are three rows of tectiform scales" and two anterior temporals. The most noteworthy similarity is probably that the "upper preocular is fused with prefrontal," a feature quite characteristic of *O. subcinctus*, with which the rest of the scale formula also agrees, viz, Sc. 17; v. 211; a. 1 (exceptional); c. 80. As for the locality, "Japan," it should be noted that it is simply a surmise of Mueller's, based upon the fact that the snake was found in a jar which also contained a Japanese mole (*Talpa wogura*). The jar, however, was labeled "Java," and Java is just the type-locality of *Ophites subcinctus*. It should be noted, however, that Mueller later[e] referred the specimen to *Dinodon orientale* (*Ophites japonicus*).

Dinodon is a very compact little genus of four species. Its center of distribution seems to be China. One species may extend as far west as the Himalayas, one is thus far found only in Hondo, Japan, another in Kiusiu and the Riu Kius, while a third extends from Hainan in the south to Vladivostok in the north.

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[a] Ann. Mag. Nat. Hist. (4), I, 1868, p. 426.

[b] As to *Ophites* [*Lycodon*] *aulicus*, see footnote on p. 358.

[c] Cope has given no such name, so far as I know; probably Mueller meant *E. semicarinatus*.

[d] Verh. Naturf. Ges. Basel, VII, 1885, p. 685.

[e] Idem, VIII, Pt. 2, 1887, p. 270.

The genus is not found in any portion of the Malayan region. In the latter it is represented by the genus usually known as *Lycodon*.[a]

KEY TO THE SPECIES OF DINODON.

*a*¹ Anal entire; a preocular.
  *b*¹ Scales smooth; less than 210 ventrals.
    *c*¹ Ventrals 189 (185)–209 (average 198); cross-bars on body and tail more than 60 . . . . *D. rufozonatum*, p. 358
    *c*² Ventrals 178–195 (average 189); cross-bars on body and tail less than 60. *D. rufozonatum walli*, p. 364
  *b*² Scales feebly keeled; more than 210 ventrals.
    *c*¹ Portion of rostral visible from above half as long as the interprefrontal suture. *D. semicarinatum*, p. 366
    *c*² Rostral just visible from above . . . . *D. septentrionale*, p. 370
*a*² Anal divided; no preocular . . . . *D. orientale*, p. 372

DINODON RUFOZONATUM[b] (Cantor).

1840. *Lycodon rufozonatus* CANTOR, Zool. Chusan (pl. XI) (type-locality, Chusan, China; type in Brit. Mus.; Cantor, collector).—GUENTHER, Rept. Brit. India, 1864, p. 319 (Chusan); Ann. Mag. Nat. Hist. (4), I, 1868, p. 426 (Formosa).—JAN, Icon. Ophid., livr. 36, 1870, pl. IV, fig. 3 (Chusan).—STEINDACHNER, Sitz. Ber. Wien Akad. Wiss., Math. Naturw. Cl., LXII, Pt. 1, 1870, p. 338; author's separate, p. 13 (Peking).—MUELLER, Verh. Naturf. Ges. Basel, X, Pt. 1, 1892, p. 205 (Vladivostok).—*Dinodon rufozonatus* PETERS, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1881, p. 89.—BOULENGER, Cat. Snakes Brit. Mus., I, 1893, p. 361 (Hainan; Formosa; Tsushima; northern China).—BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 38 (part: Formosa).—WALL, Proc. Zool. Soc. London, 1903, pp. 89, 100 (part: Formosa; Korea; Tsushima).—WERNER, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 354 (Ningpo Mts. near Shanghai).

1854. *Dinodon cancellatum* DUMÉRIL and BIBRON, Erpét. Gén., VII, Pt. 1, p. 477 (type-locality unknown; type in Paris Mus.).

1856. *Coronella striata* HALLOWELL, Proc. Phila. Acad., 1856, p. 152 (type-locality, Ningpo, China; types in Phila. Acad. Mus.; McCartee, collector).—*Eumesodon striatus* COPE, Proc. Phila. Acad., 1860, p. 263.

1885. *Dinodon rufozonatus* var. *formosana* BOETTGER, Offenbach. Ver. Naturk. 24–25 Ber., p. 125 (type-locality, Formosa; type in Mus. Senckenb.); 26–28 Ber., 1888, p. 144 (Formosa).

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[a] *Lycodon aulicus* (*Coluber aulicus* LINNÆUS, Syst. Nat., 10 ed., I, 1758, p. 220) is credited to Formosa by Doctor Wall (Proc. Zool. Soc. London, 1903, p. 88) on the strength of a specimen in the Hongkong City Hall Museum now so labeled. He states that the specimen from Hongkong, which Boettger, upon the authority of von Moellendorff, recorded as being in that museum (Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 84) is found there no longer, but, on the contrary, that the only specimen of *L. aulicus* in that institution is from Formosa. It is greatly to be apprehended that the specimen in question, or rather its label, has been a victim of the typhoon mentioned by Doctor Wall in the introduction to his paper (p. 84). He there expressly states that the circumstances render the accuracy of some of the records open to question. In view of the probability that the original Hongkong specimen and the one now labeled as from Formosa are one and the same, I find it inadvisable to admit *Lycodon aulicus* to the fauna of Formosa on the strength of this record.

[b] Signifying with red belts, or bands.

Description.—Adult male; U.S.N.M. No. 14614; Korea?; Dr. N. M. Ferebee, collector. Rostral about one and a half times as broad as high, the portion visible from above equaling about one-third its distance from frontal; internasals very much smaller than prefrontals, which are broadly in contact with supraocular; frontal short and broad, its length equaling its distance from rostral and shorter than interparietal suture, its width anteriorly nearly equaling its length, and its width at a line through the center of the eyes twice as great as that of the supraoculars at the same line; parietals large, twice as long as prefrontals; nostril large, between two nasals, of which the posterior is the larger; loreal twice as long as high, entering eye below the small preocular, which is widely separated from frontal; two postoculars; temporals 2 + 3, the upper one of the second row bordering the parietal very large; 8 supralabials, third, fourth, and fifth entering eye, sixth and seventh subequal, largest; five lower labials in contact with anterior chin-shields, which are considerably longer than the posterior; 17 rows of scales, which are smooth except a few median dorsal rows on the posterior fourth of the body, which show faint keels at the base of the scales; 197 ventrals; anal entire; 71 pairs of subcaudals. Color (in alcohol) pinkish buff (in life said to be coral red) with about 58 broad, dark brown cross-bars on upper side of body and 23 on tail, the bars being separated by narrow bands, about the width of a scale, of the ground color; a series of alternating dark blotches on the sides involving the four outer scale rows and the upturned end of the ventrals; top of head isabella-color with ill-defined pale borders to many of the shields; labials and underside uniform pale, that of the tail with irregular dusky blotches.

Dimensions.

	mm.
Total length	1,063
Snout to vent	863
Vent to tip of tail	200

In a *younger* specimen, from the country between Tientsin and Peking (No. 29701), all the dark markings are solid black, even the top of the head and the light edges to the head shields are better contrasted. There is, moreover, a somewhat ill-defined black transocular spot from nostril to the temporal region with radiating black edges to the supralabials.

Variation.—With the exception of the scutellation of the sides of the head this snake is not subject to great variation. Thus of 29 recorded specimens only one has 2 scale rows over the normal number, 17.[a] The number of supralabials 8 is fairly constant, 7 occurring only rarely. Temporals also are nearly always 2 + 3, but Boettger records a Formosa specimen with 2 + 2 and Doctor Wall one specimen with a single temporal in the first row. He also mentions a specimen with three postoculars on both sides and one with three on one side. The greatest variation is seen in the relation of the loreal and the consequent relation of the supralabials to the eye. In our specimens it reaches the eye in one, but not in the other. In 16 Chinese specimens examined by Doctor Wall it touched the eye in 11 and did not reach it in 5, while in the large series of Chinese specimens recorded by Boulenger, viz, 23, the proportion must have been quite different, as in the description of the species he says "loreal elongate, sometimes entering the eye." The resultant variations in the relation of the supralabials to the eye are given by Boulenger as rare, viz, second, third, and fourth, or only fourth and fifth entering eye. The number of lower labials in touch with anterior chin-shield is also subject to some variation, Doctor Wall having found four on both sides in one, and six on one side in two specimens. The normal range of variation in the number of ventrals seems to be between 189 and 209, 185 as recorded by Boulenger in a young Shanghai specimen being quite abnormal; 57 subcaudals in another specimen of the same origin is also considerably below the normal range, which appears to be 62 to 83. It will be noted that the Formosa specimens average a greater number of subcaudals than the specimens from the mainland of China, but the overlapping is not only very great but appears to be uncorrelated with other characters.

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[a] Dr. J. S. Thompson, U. S. N., in a letter dated February 9, 1907, informs me that he has a specimen from Formosa with 19 scale rows.

The number of dark cross-bars on body and tail varies considerably within the limits of 68 and 99 in the specimens in which they have been recorded, the greatest range being on the body, viz, 50 to 75, as against 18 to 24 on the tail.

Habitat.—The present species extends over a large portion of eastern China, including the islands of Hainan,[a] Formosa, and Chusan, ranging northward at least as far as Vladivostok, from which locality a specimen has been recorded by Mueller as being in the Basel Museum. It also occurs in Korea, but no definite locality has been recorded, the only specimen of certain Korean origin being in the Michigan University museum.

Holst sent two specimens from Tsushima to British Museum.

It has not been recorded from Japan proper. A fine specimen of the continental type, in the United States National Museum (No. 14614), collected by Dr. N. M. Ferebee, U. S. Navy, is credited on the record book to Nagasaki, but there is no original label or any other original document to corroborate this locality of this specimen which came with a collection all the other specimens of which are from Korea. As the entries of that particular time when this specimen was received are not to be entirely depended on, it seems most probable that this specimen was really collected in Korea.

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[a] Regarding this locality, see under *Elaphe dione*, p. 318, footnote.

In Formosa the species seems to be common and to agree with the continental form in the number of dorsal spots. British Museum has numerous specimens from the island, the Senckenberg Museum has one, and the Hamburg Museum several collected by Doctor Warburg both in the southern and the northern part of Formosa (Nos. 1526, 1527). Similarly, the museum in Christiania has two specimens collected by Mr. Navara.

List of specimens of Dinodon rufozonatum.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.	Dark cross-bars.
U. S. N. M	14614	(a)	Korea		Dr. N. M. Ferebee	17	197	1	71	2+3	8	81
Do	29701	Male	Peking, China		M. L. Robb	17	200	1	68	2+3	8	68
Mich. Univ	30527	do	Korea		G. A. Olinger	17	208	1	75	2+3	7–8	99
Brit. Mus	*w*	do.[b]	Tsu shima		P. A Holst	17	204	1	68			
Do	*x*	do.[b]	do		do	17	202	1	68			
Do	*b*	do.[b]	Formosa		R. Swinhoe	17	189	1	76			
Do	*c*	Young[b]	do		do	17	199	1	83			
Do	*d*	Female[b]	do		Taiwanfu Mus	17	199	1	71			
Do	*e*	do.[b]	do		do	17	198	1	73			
Do	*f*	Halfgr.[b]	do		do	17	204	1	75			
Do	*g*	Young[b]	do		do	17	193	1	73			
Do	*h*	do.[b]	do		do	17	199	1	81			
Do	*i*	do.[b]	do		do	17	192	1	76			
Do	*k*	do.[b]	do		do	17	190	1	79			
Senckenberg	7361[b]	Adult[c]	do		F. Knoblauch	17	205	1	76	2+2	7–8	79
Paris		do.[d]	?		Doctor Smith	17	194	1	68		8	70
Brit. Mus	*l*	Halfgr.[e]	Chusan, China		Doctor Cantor	17	193	1	72			80
Do	*m*	Male[f]	Shanghai, China		R. Swinhoe	17	190	1	65			
Do	*n*	Young[f]	do		do	17	198	1	57			
Do	*o*	do.[f]	do		do	17	201	1	68			
Do	*p*	do.[f]	do		do	17	185	1	69			
Do	*q*	Halfgr[f]	Kiukiang Mountains, China		C. Maries	17	203	1	67			
Do	*r*	Female[f]	Mountains north of Kiukiang, China		A. E. Pratt	17	203	1	72			
Do	*s*	Male[f]	Province of Szeshuen, China		do	17	204	1	72			
Do	*t*	Female[f]	West Hills, Peking, China		S. W. Bushell	17	194	1	65			

Brit. Mus.	u	Female [f]	West Hills, Peking, China		S. W. Bushell	17	193	1	65			
Do.	r	do. [f]	do.		do.	17	204	1	62			
Do.	a	Male [g]	Hainan Island, China		J. Neumann	17	202	1	73			
Munich		Female [h]	Ningpo Mountains, China		Doctor Haberer	19	198	1	65			

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[a] Description, p. 359.
[b] Boulenger, Cat. II, p. 362.
[c] Boettger, p. 125; type of *D.* var. *formosana.*
[d] Duméril and Bibron, p. 449; type of *D. cancellatum.*
[e] Boulenger, Cat. II, p. 362; type.
[f] Boulenger, Cat. II. p. 362.
[g] Boulenger, Cat. II, p. 361.
[h] Werner, p. 354.

DINODON RUFOZONATUM WALLI,[a] new subspecies.

1895. *Dinodon rufozonatus* Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 108 (Miyakoshima group, Riu Kius) (not of Cantor); Kat. Schl. Mus. Senckenberg., 1898, p. 38 (part: Miyakoshima).—Wall, Proc. Zool. Soc. London, 1903, pp. 89, 100 (part: Japan, Loo Choos; 1905, II, p. 515 (Miyako; Ishigaki; Iriomote).

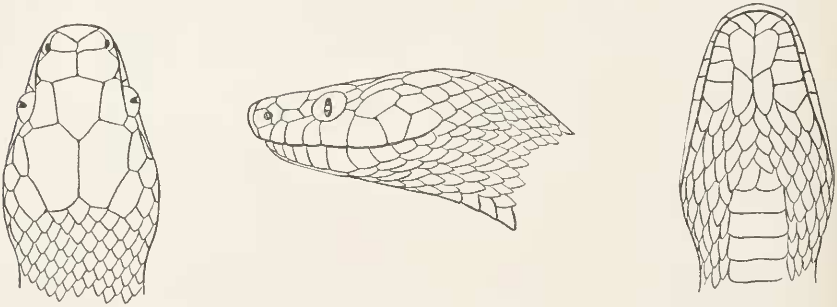
Diagnosis.—Similar to typical *Dinodon rufozonatum*, but with fewer ventrals, viz, 178–195 (average 189), and fewer dark cross-bars on body and tail, viz, 22 to 32 on body and 15 to 20 on tail, or together on both, 41 to 52 (average 45); a pale inverted V on the nape; underside more or less mottled with brown (figs. 307–309).

Type.—U.S.N.M. No. 34007; Ishigaki shima, Yaeyama group; June, 1899; Owston collection.

Habitat.—Riu Kiu Archipelago.

Remarks.—While in Frankfort on the Main in 1898 Doctor Boettger had the great kindness to show me the specimens of this species in the Senckenberg Museum. Unfortunately, I did not have time to examine them in detail, but I made the note that the Formosa specimen appeared to have about twice as many dorsal spots (56 according to Boettger) as those from the Riu Kius. This observation I have had an opportunity to test on only eight additional specimens, but in these I find a similar proportion inasmuch as in five specimens from the southern Riu Kius,[b] the dorsal spots are only 32, 29, 29, 25, and 26, respectively, while in two specimens from Korea and one from northern China, Tientsin, or Peking, the numbers are 75, 58, and 50.[c]

307 308 309



Figs. 307–309. Dinodon rufozonatum walli. 2 × nat. size. 307, top of head; 308, side of head; 309, underside of head. No. 11, Sci. Coll. Tokyo.

Doctor Wall, who examined a large number of Chinese specimens and four from Ishigaki shima (three of which are the ones now in the

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[a] Named for Capt. F. Wall, of the Indian Medical Service, author of a Prodromus of the snakes hitherto recorded from China, Japan, and the Loo Choo Islands, as well as several papers on Indian snakes.

[b] Science College Museum, Nos. 11, 12, and U.S.N.M. Nos. 34006–8.

[c] For further color distinctions, see remarks under *Variation*, p. 365.

U.S.N.M. mentioned above), as well as one alleged to be from "Japan," made similar observations, and also called attention to the lower number of ventrals and higher number of subcaudals in the latter. The numbers of these plates as given by him do not overlap, but from the tables presented by me (pp. 362 and 366) it will be seen that there is considerable overlapping. While it may thus be inexpedient to give the Riu Kiu form a binominal appellation, there can be no doubt that it should be recognized nomenclatorially.

It appears that all the names in the synonymy of *D. rufozonatum* are based upon Chinese or Formosan specimens with more than 192 ventrals and less than 73 subcaudals. The type localities of *D. rufozonatum*, *D. r.* var. *formosana*, and *C. striata* are known and agree in the scale formula. The type of *D. cancellatum* is from an unknown locality, but the scale formula as well as the number of black bars on back and tail are conclusive. Hence the necessity of giving a new name.

The number of ventrals and dorsal dark cross-bars being the chief distinctive characters of this subspecies, as indicated above, it appears superfluous to present a detailed description of a Riu Kiu specimen, but a few remarks on the individual variation within the form peculiar to the archipelago may not be out of place.

Variation.—In the five specimens before me the loreal is in every case excluded from the eye by the preocular. That this relation is not constant, however, is shown by Boettger's statement that in some of the four Miyakoshima specimens examined by him there is found two preoculars on one side, or on both sides in some, while mostly there is only one. Other variations noticed by him are three postoculars on one side in one (also found in one of the specimens before me), and only two supralabials entering the eye in another. Ventrals vary between 178 and 195 in nine recorded specimens; subcaudals between 73 and 87. The largest number of dark cross-bars in five specimens is 52, the smallest 41.

In the youngest specimen before me (Sci. Coll. No. 11) the dark markings on the upper side are nearly solid, though even in this many of the scales in the interior of the blotches have narrow pale edges. In all the other specimens, however, which are much larger, these pale edges are much broader, so that the cross-bars appear lighter brown with dark margins, the paler interior having mostly a streaky appearance.

The typical *D. rufozonatum* from the mainland seems to have the cross-bars solid-colored.

Habitat.—This race seems to be confined to the southern and middle groups of the Riu Kiu Archipelago.

Mr. Tashiro has collected specimens in the Yaeyama group, both on Iriomote shima and on Miyakoshima. The Senckenberg Museum also has specimens from the latter island and the Hamburg Museum from the former (No. 2579). United States National Museum has three specimens from Ishigaki shima, and Doctor Wall examined three more from the same island. Finally, Doctor Warburg also collected it in Okinawa shima. (Hamburg Mus. No. 1545.)

Doctor Wall also mentions a specimen in Owston's collection as from "Japan." No other locality is given, and until further evidence is produced it is permissible to question the occurrence of this species in Japan proper.

List of specimens of Dinodon walli.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals	Supralabials.	Dark cross-bars.
				1899.								
U.S.N.M.	34006	Male	Ishigaki shima	June —	A. Owston	17	195	1	82	2+3	8	45
Do	34007	Male [a]	Riukiu	do	do	17	190	1	87	2+3	8	43
Do	34008	Female	do	do	do	17	186	1	81	2+3	8	41
Sci. Coll., Tokyo.	11	Young [b]	Iriomote shima, Riukiu.	June 14	Tashiro	17	192	1	85	2+3	8	52
Do	12	Male	Miyakoshima, Riukiu.		do	17	189	1	73	2+3	8	44
Senckenb.	7361 [a]	(c)	do		B. Schmacker	17	178	1				
Do		(c)	do		do	17	181	1				
Do		(c)	do		do	17	192	1	83			
Do		(c)	do		do	17	195	1	81			

[a] Type, p. 364. [b] Figs. 307-309. [c] Boettger, p. 108.

DINODON SEMICARINATUM[a] (Cope).

AKAMATAH (on OKINAWA SHIMA, According to Mr. Tashiro).
MATSUTABU (on AMAMI-O-SHIMA, According to Mr. Nakagawa).

1860. *Eumesodon semicarinatus* COPE, Proc. Phila. Acad., 1860, p. 263 (type-locality, "Loo Choo;" type in Phila. Acad. Mus.; Heine, collector); 1861, p. 75 (identity with *L. fasciatus*).—*Dinodon semicarinatus* BOULENGER, Ann. Mag. Nat. Hist. (6), X, Oct. 1892, p. 302 (Okinawa shima); Cat. Snakes Brit. Mus., I, 1893, p. 362 (Oho shima; Great Loo Choo Island).—BROWN, Proc. Phila. Acad., June 11, 1902, p. 185 ("Loo Choo Islands").—WALL, Proc. Zool. Soc. London, 1903, p. 100 (Loo Choos); 1905, II, p. 515 (Okinawa; Amami).

1860. *Lepidocephalus fasciatus* HALLOWELL, Proc. Phila. Acad., 1860, p. 498 (type locality, "Japan and Loo Choo;" types, U. S. Nat. Mus. No. 7354).

The Perry expedition and the Rodgers expedition, according to Hallowell, brought home four specimens of this species, namely, two from "Loo Choo" by the former, two from "Japan" by the latter. One of the former was apparently donated to the Philadelphia Academy and served as type of Cope's *E. semicarinatus;* the other three are still in the U. S. National Museum as No. 7354, but the identity of each specimen was not maintained, and it is now impossible to point out with certainty their individual origin. So much is certain, however, that the specimen now designated as No. 7354*c* is *the* type of Hallowell's *L. fasciatus,* his description being based on that one alone. I venture the guess that this is the second of the Perry expedition specimens and that the other two are Stimpson's specimens from "Japan."

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[a] Signifying half-carinated, with reference to the scales being keeled only in their basal half.

There is indirect evidence that Hallowell was mistaken about these two specimens of *Lepidocephalus fasciatus* being from "Japan" as distinct from "Loo Choo." Altogether he recorded only the following land snakes as being collected by the Rodgers expedition (W. Stimpson):

From "Loo Choo:"
  P. 492. *Bothrops flavoviridis,* 1 specimen from Amakarima Island, and
  P. 493. *Eurypholis semicarinatus,* 2 specimens from near Napa, Loo Choo, caught by Mr. Wright, Nov., 1855.
From "Japan:"
  P. 498. *Leptophidium dorsale,* 1 specimen, "taken on a hillside near Hakodadi, Island of Jesso, June, 1855, by W. Stimpson."
  P. 498. *Lepidocephalus fasciatus,* 2 specimens.
  P. 499. *Amphiesma tigrinum,* 2 specimens "caught at Niphon, Japan, May, 1855, by Mr. Stimpson."[a]

Dr. W. Stimpson, in his manuscript catalogue of specimens brought home by the Rodgers Expedition, enumerates the following specimens:

From "Loo Choo":
No. *Am.* 2. Amakirrima, April, 1855.
  γ–200. Snakes taken near Napa, Loo Choo, Nov., 1854 (Wright).
  γ–199. Snake shot in a paddyfield, Loo Choo, Nov., 1854 (W. S.).
  γ–187. Snake caught at Loo Choo, under a stone in low land, Nov., 1854 (W. S.).
From Japan:
No. *γ*–249. Snake taken on a hillside near Hakodadi, I. of Jesso, Japan, June 1855 (W. S.).
  γ–275. Simoda, Island of Niphon, Japan, May, 1855 (Mr. Brooke).
  γ–277. Simoda, Island of Niphon, Japan, May, 1855 (W. S.).

It is plain that No. *Am.* 2 is *Bothrops flavoviridis;* No. *γ*–200 is *Eurypholis semicarinatus;* No. *γ*–249 is *Leptophidium dorsale;* and Nos. *γ*–275 and *γ*–277 are the two specimens of *Amphiesma tigrinum.* Thus all the specimens enumerated by Hallowell and Stimpson are accounted for except the latter's Nos. *γ*–199 and *γ*–187 from "Loo Choo" or Okinawa shima, and the former's two specimens of

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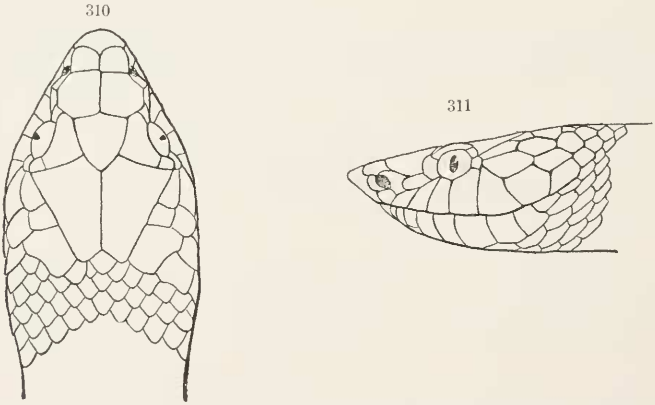
[a] The other snakes recorded are *Elaphis bilineatus,* collected by Doctor Morrow, and *Proterodon tessellatus,* without any record of locality or collector.

Lepidocephalus fasciatus. There can scarcely be the slightest doubt, therefore, that they are identical, and that Hallowell's locality, "Japan," for this species, is erroneous.

Description (figs. 310–311).—*Adult male;* U.S.N.M., No. 7354*a;* paratype of *Lepidocephalus fasciatus;* Okinawa shima; November, 1854?; W. Stimpson, collector? Rostral a little less than twice as broad as high, the portion visible from above equaling about two and a half times its distance from frontal and about one-half the interprefrontal suture; internasals small, less than half as large as the prefrontals which are broadly in contact with supraoculars; frontal broad and short, slightly longer than broad, its length less than interparietal suture and equaling its distance from rostral, the anterior outline nearly straight, the lateral outline curved to the posterior apex; supraoculars narrow, much narrower in front than behind; parietals long, nearly as long as frontal and prefrontal together; nostril large, between two nasals of which the posterior is much the larger; loreal long and narrow, twice as long as high, upper and lower edges parallel; one small preocular widely separated from frontal; two postoculars; temporals 2+3; the upper temporal of the third row very large, bordering the posterior half of the parietal externally; 8 supralabials, third, fourth, and fifth entering eye, the upper portion of the third being greatly extended posteriorly for the purpose, sixth and seventh largest; five lower labials in contact with anterior chin-shields which are somewhat longer than the posterior; 17 rows of scales, the four outer rows on each side smooth, the other with a feeble though distinct keel on the basal half of each scale; 229 ventrals with a strongly marked lateral angle; anal entire; 100 pairs of subcaudals. Color (in alcohol) pale yellowish with 40 dark crossbars on the body and about twenty on the tail, these bars having solid blackish margins while the scales inside the bars have yellow



FIGS. 310–311.—DINODON SEMICARINATUM. 1⅓ × NAT. SIZE. 310, TOP OF HEAD; 311, SIDE OF HEAD. NO. 7354*c*, U.S.N.M.

centers; alternating with these cross-bars there is a series of lateral blackish spots mostly on the four outer scale rows and more or less connected with an irregular series of single or double spots on the upturned ends of the ventrals; nape black with two yellowish spots on the outer posterior angle of the parietals and the adjacent scales; top of head blackish with ill-defined yellowish markings; sides of head yellowish, most of the shields, including the supralabials, narrowly edged with blackish; underside uniform pale yellowish, that of the tail with irregular blackish brown spots medially.

Dimensions.

	mm.
Total length	880
Snout to vent	690
Vent to tip of tail	190

The *younger* specimen, Sci. Coll. Mus., Tokyo, No. 10, is essentially like the adult. It grows to a considerable size, as a specimen from O-shima with defective tail measures 1,510 mm. in length.

Variation.—This snake does not seem to be subject to great variation, as the only abnormalities in the specimens recorded are two posterior temporals on both sides in one, nine supralabials on one side in another specimen and only two supralabials, namely, fourth and fifth, touching the eye in a third specimen. The ventrals vary between 211 and 234, and the subcaudals between 92 and 105 in the perfect specimens on record. The lowest extreme of the latter is given by Boulenger as 65, but this figure is derived from Hallowell's account of the type of *Lepidocephalus fasciatus* in which, however, the tail is mutilated.

Habitat.—Both the Perry Expedition and the Rodgers Expedition brought home specimens of this species, those from the latter being said to hail from ''Japan'' in contradistinction to the former as being from the Riu Kius, but as shown above this statement is undoubtedly erroneous. Later collectors, including Mr. Tashiro, have also obtained it in Okinawa shima, and in British Museum there is a specimen from ''Oho shima'' collected by Lieut. A. Carpenter, R. N., from which island Mr. Nakagawa also brought a specimen in 1891 to the Science College Museum. Recently other specimens from Okinawa shima and Amami-o-shima have been recorded by Dr. Wall.

In the National Museum, Ueno Park, Tokyo, there is a specimen (No. 23) of this species said to be from the province of Hiuga, southern Kiusiu. If the locality given is correct, it is the only record of the species in Japan proper, but the occurence there needs confirmation.

List of specimens of Dinodon semicarinatum.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M	7354*a*	Male[a]	Okinawa shima.	1854? Nov. —	Rodgers Exped?	17	229	1	100	2+3	8
Do	7354*b*	Female	do	do	do	17	215	1	....	2+3	8
Do	7354*c*	do.[b]	do	1853 ?	Perry Exped ?	17	218	1	....	2+3	8
Sci. Coll. Tokyo.	4	Male[c]	O-shima	1891	Nakagawa	17	233	1	....	2+3	8–9
Do	10	Young	Okinawa shima.	1887	Tashiro	17	229	1	105	2+2	8
Do	54	Adult	do	Feb. —	do	....	....	1	....	....	....
Do	54	do	do	Apr. —	do	....	....	1	....	....	....
Nat. Mus. Tokyo.	23	....	Hiuga, Kiusiu(?)	....	....	17	....	1	....	....	....
Brit. Mus	*a*	Male	Amami-o-shima	....	Lieut. A. Carpenter.	17	234	1	97	....	....
Do	*b*	do	Okinawa shima.	....	Holst	17	228	1	101	....	....
Do	*c*	Young	do	....	do	17	211	1	93	....	....
Phila. Acad	....	([d])	"Loo Choo"	....	Perry Exped. (W. Heine).	17	221	1	92	2+	8

[a] Description p. 368.
[b] Type of *L. fasciatus*; figs. 310–311.
[c] Total length 1,510 mm.; tail defective.
[d] Cope, 1860, p. 263; type.

DINODON SEPTENTRIONALE[a] RUHSTRATI[b] (Fischer).

1868. ?*Ophites albofuscus* Guenther, Ann. Mag. Nat. Hist. (4), I, 1868, p. 426 (Formosa; Brit. Mus.) (not of Duméril and Bibron).

1886. *Ophites ruhstrati* Fischer, Abh. Naturw. Ver. Hamburg, IX, Pt. 1, no. 6, p. 16, pl. II, fig. 6 (type-locality, south Formosa; types in Mus. Oldenburg; Ruhstrat, collector).

1893. *Dinodon septentrionalis* Boulenger, Cat. Sn. Brit. Mus., I, p. 363 (part: Formosa).

1899. *Dinodon septentrionalis* var. *ruhstrati* Boulenger, Proc. Zool. Soc. London, 1899, p. 165 (Formosa).

Doctor Guenther, as quoted above, in a paper dealing with new additions to the British Museum snake collection, mentions *Ophites albofuscus* with the statement: "Occurs also in Formosa; feeds on lizards." In Boulenger's catalogue there is no indication of any specimen of this species from Formosa being in British Museum. I take it, therefore, that Guenther mistook Swinhoe's specimens from Formosa for this species, a supposition the more probable as he afterwards in describing *Ophites septentrionalis* referred it to the same genus. *O. albofuscus* is restricted to Sumatra and Borneo (see p. 357).

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[a] *Ophites septentrionalis* Guenther, Proc. Zool. Soc. London, 1875, p. 233 (type-locality, unknown, but supposed to be "northern India," Boulenger giving "Himalayas or Khasi Hills (?);" Jerdon, collector).

From *Septentrionalis*, signifying northern.

[b] For Mr. Ruhstrat, who collected the types in southern Formosa.

The collective species *Dinodon septentrionale* is recorded from the eastern Himalayas or Khasi Hills, in Assam, and the Karen Hills, in Burma, to eastern China and Formosa.

The exact relation of the specimens from the various localities is not very well known, but there seem to be several color forms, of which the easternmost and the westernmost are the extremes, viz, the typical subspecies *D. septentrionale* from Assam or Himalaya, and Burma, on the one side, and *D. septentrionale ruhstrati*, from Formosa, on the other. Specimens from the Chinese coast province of Fokien, according to Boulenger,[a] are "intermediate in the pattern of coloration" between these two forms. The status of the form which occurs in the mountains of Kiukiang is still uncertain on account of scantiness of the material.

It is unfortunate that the full scale formulas of the three Fokien specimens has not been published, as altogether the formulas of only seven specimens have been recorded, and the more so since the latter seem to indicate a possible difference in the number of subcaudals in one of the races. I find, namely, that in the three Formosan specimens in which the tail was complete the subcaudals number, respectively, 103, 104, and 97, while in the three continental specimens on record they are stated to be 83, 87, and 88.

Under these circumstances it seems best to maintain, for the present at least, the subspecific distinctness of the Formosan specimens.

A partial translation of Doctor Fischer's original description of the scutellation and coloration of the Formosan specimens is subjoined, as I have not seen any specimens of this form.

Description.—South Formosa; Mus. Oldenburg; Ruhstrat, collector. Rostral just reaching the upper side of the snout; internasals slightly broader than long, longer than the prefrontals; frontal pentagonal, as broad as long, shorter than the interparietal suture; nostril between two nasals, of which the posterior is much higher than the anterior; loreal pentagonal, twice as long as high, its posterior angle reaching under the preocular; latter well developed, quadrangular, twice as high as long, resting on the third supralabial and part of the loreal, extending to the upper surface of the head, though not reaching the frontal; two postoculars, the lower resting on fifth and sixth supralabials; temporals 2+3, the two anterior in contact with both postoculars; eight supralabials, of which third, fourth, and fifth join the eye; ten infralabials, the first six in contact with the chin-shields; the posterior chin-shields somewhat narrower and but slightly shorter than the anterior; between these and the ventrals two or three rows of elongated throat scales; scales in 17 rows, only the six or eight median rows[b] weakly keeled; ventrals

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[a] Proc. Zool. Soc. London, 1899, p. 165.

[b] Must be "seven or nine," as the number of scale rows is uneven.—L. S.

221 to 223, laterally with a distinct but not sharp angle; anal single; 103 pairs of subcaudals, followed by a horny tip. Head to the middle of the frontal deep black, thence to the third scale row on the nape gray in the old specimen, pure white in the quite young one; ground color above reddish gray; numerous (47 to the anus in the old, 36 in the young) deep brown, light-edged crossbands descending on the sides almost to the ventral surface, the spots as in *O. orientalis*, cut on the posterior two-thirds of the body by a light longitudinal line on the fourth scale row, so that the portions thus cut off form a separate row of spots; alternating with these the upturned portion of many ventrals have a small brown spot, thus forming another series of spots on each side; the tail above also has a series of dark brown transverse spots, which in the young specimen extend to the ventrals, forming (18) complete rings; the brown dorsal spots gradually diminish in width posteriorly, the first one on the nape extending over 17 scales, while those following become gradually shorter, until on the second third of the body the light interspaces exceed them in width (especially in the young specimen); underside of head and body yellowish white, the tail of the old specimen grayish brown, of the young divided by complete dark rings.

Dimensions.—Young specimen: Total length, 250 mm.; tail, 60 mm.

Habitat.—The distribution of the species has been given above under the preliminary remarks.

The subspecies, *D. ruhstrati*, as here understood, is confined to the island of Formosa, where it has been collected by Mr. R. Swinhoe, and later by Mr. Ruhstraht, the specimens brought home by the former being in British Museum, while those by the latter are in the natural history museum in Oldenburg.

List of specimens of Dinodon ruhstrati.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.
Oldenburg	*a*	Adult[a]	South Formosa		Ruhstrat	17	221	1	....
Do	*b*	Young[a]	do		do	17	223	1	103
Brit. Mus	*b*	Female[b]	Formosa		R. Swinhoe	17	216	1	104
Do	*c*	do.[b]	do		do	17	224	1	97

[a] Cotypes; Fischer, p. 16.

[b] Boulenger, Cat. I, p. 363.

DINODON ORIENTALE[a] (Hilgendorf).

SHIROMADARA (Doctor IJIMA, In Letter).

1880. *Ophites orientalis* Hilgendorf, Sitz. Ber. Ges. Naturf. Fr., Berlin, 1880, p. 115, pl. —, figs. 1–5 (type-locality, Tokyo; type, Berlin Mus. No. 9419; Hilgendorf, collector).

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[a] Signifying eastern.

1880. *Ophites japonicus* GUENTHER, Ann. Mag. Nat. Hist. (5), VI, Dec., 1880, p. 462 (type-locality, Nikko, Hondo; types, in Brit. Mus.; Maries, collector).—MUELLER, Verh. Naturf. Ges. Basel, VIII, Pt. 2, 1887, p. 270 (Japan).—*Dinodon japonicus* BOULENGER, Cat. Snakes Brit. Mus., I., 1893, p. 363 (Nikko, Hondo).—BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 38 (Hondo).—WALL, Proc. Zool. Soc. London, 1903, p. 100 (Kiusiu); 1905, II, p. 513 (Yamanashi, Hondo).—NIKOLSKI, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, No. 1 (1905), p. 224 (Nagasaki).

Hilgendorf's *Ophites orientalis* was described in the Sitzungs-Bericht of the meeting held October 19, 1880, which was probably published very shortly after that date. Guenther's *O. japonicus*, on the other hand, appeared in the December number of the Annals and Magazine of the same year. There is, therefore, apparently a very brief priority in favor of Hilgendorf's description. It may be interesting to note that Hilgendorf as early as 1876 indicated this species, but refrained from naming it.[a]

Description.—*Young;* U.S.N.M. No. 34052; Mount Fuji; August, 1898; Owston collection. Rostral broader than high, the portion visible from above scarcely as long as suture between internasals; the latter small, less than half as long as prefrontals, the suture between the former only half as long as that between the latter; prefrontals broadly in contact with supraoculars and with eye; frontal as broad as long, and as long as its distance from rostral, shorter than interparietal suture; supraoculars small, less than half the size of frontal; parietals large, nearly twice as long as frontal; nostril large, round, between two subequal nasals; loreal narrow, twice as long as high, entering eye below prefrontal; no preocular; two postoculars; temporals, 2+3; a very large upper temporal of the third row bordering the posterior half of parietal externally; 8 supralabials, sixth largest, fourth and fifth entering eye; 5 lower labials in contact with anterior pair of chin-shields, which are somewhat larger than posterior; 17 rows of scales, all of which are smooth on the anterior half of the body, but on the posterior half the median 5 to 7 rows have a faint keel at the base of each scale; 207 ventrals, distinctly angulate laterally; anal divided; 74 pairs of subcaudals. Color (in alcohol) above dull ecru-drab[b] with dark brown cross-bars, 38 on the body, 15 on the tail, these bars being broader than the intervening light ground color on the anterior part of the body, but becoming gradually narrower posteriorly so as to be narrower than the light interspaces; the latter are paler colored along the edges of the dark cross-bars; on the posterior half of the body the lower part of the bars are separated off by a narrow light line between fourth and fifth scale row; on the sides of the middle third of the body there is an alternating series of vertical brown spots between the lower end of the cross-bars; top of head uniform dark brown; lower part of supralabials and entire temporal region, including the posterior lateral portion of the parietals, whitish; underside whitish with a few dusky marblings on the middle and occasional dark spots on the sides of the ventrals of the posterior half; dorsal cross-bars nearly meeting on underside of tail.

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[a] Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, July, 1876, p. 30.

[b] Hilgendorf says: "Oberseite in frischem Zustande, schmutzig braunroth, ziemlich hell."

Dimensions.

	mm.
Total length	290
Snout to vent	235
Vent to tip of tail	55

The *adult* specimens are essentially like the one described above, but this snake does not seem to reach any considerable size. Boulenger measures a total length of 660 mm. and the species probably does not grow much larger.

Variation.—Comparatively little variation is shown in the scutellation of this species, and then mostly in the temporals, the second row occasionally having only two scales. There seems also to be some variability in the number of supralabials in touch with the eye, inasmuch as both Hilgendorf and Boulenger state that in their specimens the third also enters into relation with it. In all those specimens in our museum, however, the third supralabial is excluded from the eye, the loreal being in broad contact with the fourth supralabial. Ventrals vary between 199 and 208; subcaudals between 68 and 75 pairs.

Habitat.—Apparently restricted to Japan proper. Hilgendorf in describing the species mentioned seven specimens from the neighborhood of Tokyo, mostly from the Botanical Garden, and for this reason he suspected that the species had been accidentally introduced. This suspicion seems to be unfounded in view of the many specimens which have been found in various localities both in Hondo and Kiusiu. The two specimens in the British Musum were collected by Mr. Maries at Nikko; Doctor Nordquist found a specimen at Murayama, and United States National Museum has a specimen each from Isobe near Yokohama and from "Mount Fuji;" a specimen (No. 5) from the province of Iga is in the Imperial Museum, Ueno Park, Tokyo. Finally Doctor Wall mentions one specimen from Yamanashi, Hondo, and one from Kiusiu. It was collected there as early as 1879 by Dr. O. Nordquist near Nagasaki, where another specimen, now in the St. Petersburg Museum, was collected by Doctor Slunin in 1888. Both the Nordquist specimens are in the Riksmuseum at Stockholm, where I was permitted to examine them in 1905, thanks to the kindness of the curator, Dr. Einar Loennberg.

List of specimens of Dinodon orientale.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
U.S.N.M	34052	Young [a]	Mount Fuji	1898. Aug. —	A. Owston	17	207	2	74	2+3	8
Do	34543	Halfgr.	Isobe, near Yokohama.	1904. May 10	do	17	201	2	....	2+2	8
Do	36542	do. [b]	Tokyo		Sci. Coll., Tokyo	17	203	2	73	2+2	8
Sci. Coll., Tokyo.	64	Female	do			17	199	2	75	2+3	8
Stockholm	418	do	Murayama, Hondo	1879. Nov. 27	Dr. O. Nordquist	17	201	2	72	2+3	8
Do	419	Male	Nagasaki, Kiusiu.	Dec. —	do	17	203	2	74	2+2	8
Berlin	9419	Young [c]	Tokyo	1874. May —	Doctor Hilgendorf.	17	200 or 208	2	74	2+2	8
Brit. Mus	*a*	Female [d]	Nikko		C. Maries	17	202	2	68	2+3	8
Do	*b*	do	do		do	17	205	2	70	2+3	8

[a] Description, p. 373.
[b] Sci. Coll., No. 64a.
[c] Type, Hilgendorf, p. 116.
[d] Cotypes of *O. japonicus*, Boulenger, Cat. I, p. 364.

Genus CALAMARIA[a] Boie.

1827. *Calamaria* Boie, Férrusac, Bull. Sci. Nat., IX, p. 236 (type, *Coluber calamarius*).

1834. *Changulia* Gray, Ill. Ind. Zool., II, (pl. LXXXVI), (type, *C. albiventer*).

The range of the genus embraces the Malayan archipelago, extending into Burma, southern China, and the Philippine archipelago. One species is from the southern and middle group of the Riu Kiu archipelago, and one is here recorded from Formosa for the first time.

Of the Calamarias with four supralabials there is a small compact group containing *C. brevis*, from an unknown locality; *C. pavimentata*, from Java; *C. siamensis* from the Indo-China peninsula and southern China; *C. berezowskii* from the upper Yangtse Valley and Formosa; *C. septentrionalis* from the lower Yangtse and the coast of China; and *C. pfefferi* from the Riu Kiu Archipelago. Boulenger has united *C. pavimentata* and *C. siamensis* under the former name, but while I have no specimens for comparison, the figures and descriptions show such contradictions that I can not consider the question finally settled. A long narrow head is characteristic of *C. brevis* and *C. pfefferi*, which also agree in the lack of a yellow collar and light spots. They are probably nearly related. On the other hand *C. siamensis, berezowskii,* and *septentrionalis* are very closely allied and I have some doubts whether they are properly separated and whether the specimens from

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[a] Signifying like a reed, from καλαμος, a tube, a straw.

China and Indo-China may not be grouped to better advantage and more consonant with their geographical distribution, questions I am unable to solve at present on account of lack of material.

The two species which are found within our territory may be distinguished as follows:

a^1 Head wide; the width of parietals together more than half the distance from tip of snout to their posterior end; suture of frontal with supraocular shorter than with prefrontal; a yellowish, more or less interrupted nuchal collar; ventrals uniform pale .... *C. berezowskii*, p. 376.

a^2 Head narrow; the width of the parietals together equals one-half their distance from tip of snout to their posterior end; suture of frontal with supraocular longer than with prefrontal; no collar; ventrals strongly spotted with black. *C. pfefferi*, p. 378.

CALAMARIA BEREZOWSKII[a] Guenther.

1896. *Calamaria berezowskii* Guenther, Annuaire Mus. Zool. St. Pétersbourg, I, p. 205, pl. I, fig. A (type-locality, Luu-ngan-fu, Prov. Sze-chuen, China; types in Mus. St. Petersb.; Berezowski, collector).

A specimen of a *Calamaria* which seems to belong to this species, collected by Mr. Tsunasuke Tada at Taipa, Formosa, was accidentally omitted from my account of the collection made by him,[b] and is here introduced into the Formosan fauna for the first time.

There is nothing in Doctor Guenther's description or figures of *C. berezowskii* by which I can separate this specimen from it. One would naturally expect the Formosa specimen to agree with *C. septentrionalis* which occurs from Hongkong, on the mainland opposite, to Chusan in the north and to the mountains north of Kiukiang on the Yangtse River, in the interior, but this form is described as having the rostral scarcely visible from above and the tip of tail rounded. Our specimen has the same wide frontal as *C. berezowskii*, which according to Guenther is the character distinguishing it from *C. siamensis*. The latter has been taken as far north as Canton.

Curiously enough, the Formosa specimen shows no special inclination towards *C. pfefferi* from the Riu Kius, and it is quite likely that a form of the latter type may eventually turn up in Formosa also.

Description.—Adult male; Science College Museum, Tokyo, No. 12; Taipa, Formosa; September, 1897; T. Tada, collector (fig. 312). Rostral high as broad, the portion visible from above more than half as long as suture between prefrontals; no internasals; prefrontals slightly smaller than frontal, in contact with first and second supralabials; frontal slightly longer than broad, the width equaling its distance from tip of snout and the interparietal suture, about three times as wide as supraoculars, six-sided forming an obtuse angle in front and a nearly right angle behind, sutures with supraoculars shorter than those with prefrontals; parietals in contact with fourth supralabial, shorter than their distance from tip of snout, rather broad; nostril small, in a very small and narrow triangular nasal between rostral, first supralabial and prefrontal; one preocular; one postocular; no temporals; a large shield bordering posterior half of parietal behind fourth supralabial; four supralabials, first and third subequal, small, second twice as large as third, fourth as long as second and third together, second and third entering eye; first lower labials in contact with each other behind mental; three lower labials in contact with anterior chinshields, which are in contact with each other and as long as the posterior; 13 rows of smooth scales, without pits; 160 ventrals; anal undivided; 23 pairs of subcaudals; tail rather tapering, pointed at tip. Color (in alcohol) above cinnamon-brown, each scale darker edged so that the whole upper surface appears finely reticulated, the margins on the sides more emphasized on the lateral scales so as to almost form narrow longitudinal lines; on upper neck two large yellowish spots, or an interrupted yellowish collar, four scales from the head, and on the posterior angle of each parietal a similar but smaller round spot; top of head and occiput between parietals and collar much darker brown; upper and lower labials irregularly marked with dark brown; underside uniform whitish, ventrals with the lateral edge brownish like the scales; subcaudals marked with dark brown so as to form an ill-defined median band; no pale spots on tail.

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[a] Named after Mr. M. Berezowski, the Russian explorer, who in 1892–1894 traveled in the Chinese provinces of Kansu and Sze-chuen. During this journey he collected the types of this species.

[b] Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, pp. 215–225.

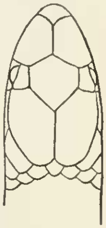

FIG. 312.—CALAMARIA BEREZOWSKII. 4 × NAT. SIZE. TOP OF HEAD. No. 12, SCI. COLL. TOKYO.

Dimensions.

	mm.
Total length	195
Snout to vent	177
Vent to tip of tail	18

The *female* has shorter tail with fewer subcaudals.

Habitat.—This species is only known from the two types collected by Mr. Berezowski in the Chinese province of Sze-chuen, and the specimen brought home by Mr. T. Tada from Taipa, Formosa, where he obtained it in September, 1897. It is probably also to be found in the intervening territory.

List of specimens of Calamaria berezowskii.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Supralabials.
Sci. Coll., Tokyo.	12	Male[a] ..	Taipa, Formosa...	1897. Sept. —	T. Tada........	3	160	1	23	1,1	4
St. Petersb..	....	([b])	Lun-ngan-fu, Szechuen.	1893.....	M. Berezowski..	....	155	....	22	1,1	4
Do......	....	([b])	.....do............	1893.....	.....do..........	....	167	....	14	1,1	4

[a] Description p. 376. [b] Type, Guenther, p. 205.

CALAMARIA PFEFFERI[a] Stejneger.

1901. *Calamaria pfefferi* STEJNEGER, Proc. Biol. Soc. Washington, XIV, Dec. 12, 1901, p. 191 (type-locality, Miyakoshima, Sake shima group, Riu Kius; type, Science Coll. Mus. Tokyo, No. 14).

1903. *Calamaria pavimentata* WALL, Proc. Zool. Soc. London, 1903, p. 101 (not of Duméril and Bibron).

Doctor Wall[b] expresses the opinion that my *C. pfefferi* is nothing but *C. pavimentata* [Boulenger, not Duméril and Bibron, =*siamensis* Guenther], but nothing shows better than this case how dangerous it is to "lump" species without having seen the material upon which they are based or without having at least material from the type locality. As a matter of fact, it is not to the form mentioned by Doctor Wall, but to Boulenger's *C. brevis* that our Riu Kiu species is most nearly related. With the latter it shares the long and narrow head as well as the plain upper surface and spotted underside, and the chief differences appear to be the shorter parietals and the low number of ventrals in the latter. Unfortunately, the habitat of the unique type of *C. brevis* is not known, and the exact relationship of these two forms must consequently remain unsettled until more material shall have been accumulated and direct comparisons between typical specimens instituted.

Description.—Halfgrown female; Science College Museum, Tokyo, No. 14. Miyakoshima, Riu Kiu archipelago; type (figs. 313–316). Rostral about as high as broad, the portion visible from above nearly as long as suture between prefrontals; no internasals; prefrontals smaller than frontal, in contact with first and second supralabials; frontal considerably longer than broad, the width equaling the distance from tip of snout but shorter than interparietal suture, about three and a half times as wide as supraoculars, six-sided, forming an obtuse angle in front and an acute one behind, sutures with supraoculars longer than those with prefrontals; parietals in contact with fourth supralabial, longer than their distance from tip of snout; the suture between them twice as long as that between prefrontals, rather narrow, especially posteriorly; nostril small, in a small nasal between rostral, first supralabial and prefrontal; one preocular; one postocular; no temporals; a large single shield bordering posterior half of parietal behind fourth supralabial; four supralabials, fourth largest, three times as large as second which is somewhat larger than first and third, second and third entering eye; first pair of lower labials forming a suture behind mental: two pairs of subequal chin-shields in contact with each other; scales smooth, in 13 rows without apical pits: 160 ventrals; anal undivided; 15 pairs of subcaudals; tail ending in a very short spine. Color (in alcohol) above brownish gray with 9 parallel darker stripes commencing directly behind the parietals; of these stripes the median one covers the entire width of the vertebral scale row, while the others only occupy the lines between the scale rows, viz, on each side, one between the ventrals and first scale row, and one between first and second and one between second and third rows, and finally one between fourth and fifth rows; head slightly paler than the body with a few rather irregular and ill-defined darker markings; an ill-defined dark band from nostril through eye and over upper portion of fourth supralabial; labials below this band and entire

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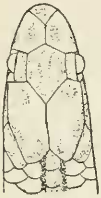
[a] Named in honor of Dr. George Pfeffer, curator in the Natural History Museum, Hamburg.

[b] Proc. Zool. Soc. London, 1903, p. 93, footnote.

313



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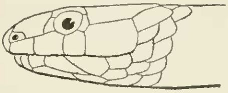

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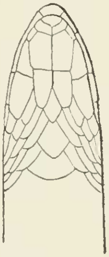

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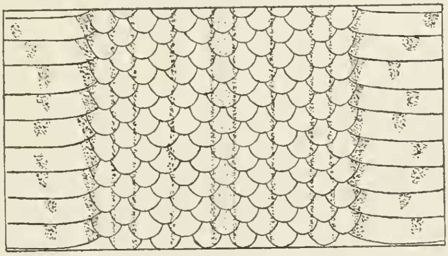

Figs. 313–316.—Calamaria pfefferi. 4 × nat. size. 313, top of head, with color pattern; 314, side of head; 315, underside of head, enlarged; 316, color pattern around middle of body. No. 14, Sci. Coll. Tokyo.

underside pale yellowish, each ventral usually marked with two well-defined, but irregularly placed, dark brown spots which, however, show a tendency to an arrangement in two longitudinal rows; under the tail a broad well-defined median band of similar color occupying the suture between the subcaudals and also extending down the middle of the anal; no nuchal collar, nor any yellowish spots at base of tail.

Dimensions.

	mm.
Total length	162
Snout to vent	152
Vent to tip of tail	10

The *male* is distinguished by a longer tail with a larger number of subcaudals.

Variation.—A specimen from Okinawa shima in the Hamburg Museum (No. 1567) collected by Doctor Warburg is very similar in scale formula, viz, sc. 13; v. 158; a. 1; c. 15; oc. 1–1; l. 4; 1st pair of lower labials in contact behind mental; second pair of chin-shields in contact; frontal four times as broad as supraocular; parietals longer than frontal. Coloration is also essentially like the one described above, there being no collar, and no yellow spots at base of or at end of tail, but there are two dorsal stripes more; the median dark stripe is two scales wide and separated by an interspace of equal width on both sides from the other stripes, of which there are five on each side; belly irregularly spotted with dark brown; a broad dark stripe along middle of underside of tail.

Science College Museum No. 13, from Okinawa shima is also similar in coloration, lacking collar and spots on tail, but has 26 pairs of subcaudals, being a male.

Habitat.—Thus far this Calamaria is only known from the Riu Kiu Islands, where it has been collected both in the southern group, viz, on Miyakoshima, and in the middle group, on Okinawa shima, a specimen from each of these localities being in the Tokyo Museum. A third specimen, from the latter island where Doctor Warburg collected it, is in the Hamburg Museum.

List of specimens of Calamaria pfefferi.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Supralabials.
Sci. Coll. Tokyo.	14	Female[a]	Miyakoshima, Riu Kiu.	......	......	13	160	1	15	1–1	4
Do	13	Male	Okinawa shima, Riu Kiu.	......	......	....	....	....	26	....	....
Hamburg	1567	(b)	do	......	Doctor Warburg	13	158	1	15	1–1	4

[a] Type; description p. 378; figs. 313–316.

[b] P. 380.

Subfamily BOIGINÆ.

There does not seem to be any convincing proof that these snakes, although provided with grooved fangs at the posterior end of the maxilla, are particularly close allies of the other opisthoglyph snakes, such as the *Homalopsinæ*. Nor do the *Langahinæ* which, like the latter and the Natricine snakes, have the hypopophyses present throughout the vertebral column, and which form a group chiefly confined to Madagascar, appear to belong here.

Like the coronelline subfamily the present one contains forms of very varied habits, arboreal, terrestrial, and subterranean, diurnal and nocturnal, etc.

Their distribution is chiefly tropical and southern both in the Old and the New World. The subfamily is therefore represented within our limits by only two genera, each with a single species, both recorded from Formosa.

They may be distinguished as follows:

*a*¹ Maxillary teeth subequal in front of the enlarged posterior grooved fangs; nostril between two nasals; scales with apical pits; scale rows 21; more than 200 ventrals; anal double . . . . *Boiga kræpelini*, p. 381.

*a*² Third or third and fourth maxillary teeth much enlarged; nostril in an undivided nasal; scales without pits; scales in 17, or rarely 19, rows; less than 180 ventrals; anal entire . . . . *Psammodynastes pulverulentus*, p. 383.

Genus BOIGA [a] Fitzinger.

1826. *Boiga* Fitzinger, Neue Classif. Rept., pp. 29, 31 (type, *Coluber irregularis*).
1843. *Dipsadomorphus* Fitzinger, Syst. Rept., p. 27 (type, *Dipsas trigonata*).
1843. *Macrocephalus* Fitzinger, Syst. Rept., p. 27 (type, *Dipsas drapiezii*).
1843. *Gonyodipsas* Fitzinger, Syst. Rept., p. 27 (type, *Dipsas irregularis*).
1843. *Eudipsas* Fitzinger, Syst. Rept., p. 27 (type, *Dipsas cynodon*).
1843. *Cephalophis* Fitzinger, Syst. Rept., p. 27 (type, *Dipsas dendrophila*).
1853. *Opetiodon* Duméril, Prodr. Class. Ophid., p. 98 (type, *O. cynodon*).
1853. *Triglyphodon* Duméril, Prodr. Class. Ophid., p. 111 (type, *T. irregulare*).
1857. *Toxicodryas* Hallowell, Proc. Phila. Acad., 1857, p. 60 (type, *T. blandingii*).
1877. *Pappophis* MacCay, Proc. Linn. Soc. New S. Wales, II, p. 39 (type, *P. laticeps*).
1895. *Liophallus* Cope, Proc. Phila. Acad., 1894, p. 427 (type, *Dipsas fusca*).

Fitzinger's *Boiga*, of 1826, clearly takes precedence over his *Dipsadomorphus* of 1843, as shown by me.[b]

BOIGA KRÆPELINI [c] Stejneger

1902. *Boiga kræpelini* Stejneger, Proc. Biol. Soc. Washington, XV, p. 16 (type-locality, Kelung, Formosa; type in Naturh. Hist. Mus., Hamburg, No. 1565; Doctor Warburg, collector).—*Dipsadomorphus kræpelini* Wall, Proc. Zool. Soc. London, 1903, p. 94 (Formosa).

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[a] "La Boiga" is a name given by the early French ophiologists to some brilliantly colored tropical snake. The name is probably of barbaric origin. Agassiz suggests its connection with Boa, but apparently with no good reason.

[b] Proc. Biol. Soc., Washington, XV, 1902, p. 16.

[c] Dedicated to Prof. K. Kræpelin, director of the Natural History Museum in Hamburg.

Description of type specimen.—Naturh. Mus. Hamburg, No. 1565; Kelung, Formosa; Doctor Warburg, collector. About 11 solid maxillary teeth, subequal, slightly separated from grooved fangs, which are not much enlarged; head very distinct from neck; eye large, equaling its distance from anterior border of nostril, with vertically elliptical pupil; rostral wider than high, barely visible from above; internasals much broader than long, much shorter than prefrontals; frontal as long as broad, as long as its distance from rostral and as the interparietal suture; nasals large, posterior concave; loreal higher than long; 2 preoculars, the upper one reaching the upper surface of the head, but separated widely from frontal; 2 postoculars; temporals 4+5, scale-like, irregular; 9 supralabials, of which the third, fourth, and fifth enter the eye; 5 (on one side 6) lower labials in contact with anterior chin-shields, which are much larger than the posterior pair; body compressed, about twice as high as wide; scales in 21 oblique rows, smooth, with apical pits, the vertebral row scarcely enlarged, the scales pointed behind; ventrals, 245, flat underneath, obtusely angulate laterally; anal double; subcaudals, 142 pairs. Color brownish gray, with about 57 darker cross-bars composed of black-edged scales from neck to anus, these cross-bars extending on the sides to about 4 scale rows from the ventrals; only faint indications of alternating lateral spots; top of head uniform brown; underside pale with a median area more grayish and laterally bordered by an irregular dusky line following the ventral angle.

Variation.—The color description of specimen No. 1569, Hamburg Mus., which was also collected by Doctor Warburg near South Cape, Formosa, is as follows: Ground color paler and more grayish than the type (No. 1565), with better defined cross bands, which alternate with a row of lateral spots approximately covering the third, fourth, and fifth rows from the ventrals; the ventral median area darker and better defined; head with a median dark line on internasal and prefrontal sutures and middle of frontal, reappearing on the anterior part of upper neck as a median elliptical, brown spot; a similar brownish band from posterior half of supraoculars posteriorly to side of neck, where it joins another originating on the upper part of the rostral and running obliquely through nostril and eye over posterior supralabials to side of neck; between these lines a pale gray band with whitish edges; supralabials also pale, more or less marked with dusky and with a dusky spot on the suture below the center of the eye.

The specimen in the Hongkong City Hall Museum examined by Doctor Wall had six temporals on one side and ten labials on one side; fiv lower labials in contact with anterior chin-shields on both sides.

Remarks.—Kræpelin's Boiga differs from most of the other species of the genus in having a double anal and a scarcely enlarged vertebral scale series; also in the very short posterior chin-shields, and especially in the numerous small temporals.

Habitat.—This species is only known from Formosa, where two specimens were collected by Doctor Warburg, one at Kelung, in the northern part, the other near South Cape. A third specimen from Formosa is in the Hongkong Museum, as reported by Doctor Wall.

List of specimens of Boiga kræpelini.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Temporals.	Supralabials.
Hamburg[a].	1565	......	Kelung, Formosa	....	Dr. O. Warburg.	21	245	2	142	4 +5	9
Do.[b]	1569	......	Near South Cape, Formosa.	....	do	21	232	2	143	5 +4	9–10
Hongkong[c]	......	......	Formosa	....	....	21	244	2	140	....	9–10

[a] Type: description, p. 382.
[b] P. 382.
[c] Wall, p. 94.

Genus PSAMMODYNASTES[a] Guenther.

1858. *Psammodynastes* GUENTHER, Cat. Colubr. Sn. Brit. Mus., p. 140 (type, *P. pulverulentus*).

1904. *Thamnodynastes* WERNER, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, p. 372 (*lapsus*; not of Wagler, 1830).

1905. *Anisodon* ROSÉN, Ann. Mag. Nat. Hist. (7), XV, Feb., 1905, p. 176 (type, *A. lilljeborgi*) (not of Lartet, 1849).

1905. *Anisodontes* ROSÉN, Ann. Mag. Nat. Hist. (7), XVI, Aug., 1905, p. 128 (substitute).

PSAMMODYNASTES PULVERULENTUS[b] (Boie).

1827. *Psammophis pulverulenta* BOIE, Isis, 1827, p. 547 (type-locality, Java).—SCHLEGEL, Phys. Serp. II, (1837), p. 211, pl. VIII, figs. 10–11 (Java).—*Psammodynastes pulverulentus* GUENTHER, Cat. Colubr. Sn. Brit. Mus., 1858, pp. 140, 251 (Philippines; Sumatra; India).—BOULENGER, Cat. Sn. Brit. Mus., III (1896), p. 172 (Eastern Himalayas, etc.; Formosa).

1839. *Dipsas ferruginea* CANTOR, Proc. Zool. Soc. London, 1839, p. 53 (type-locality, Assam; type? in Brit. Mus.; Cantor, collector).

1867. *Lycodon bairdii* STEINDACHNER, Novara Exped., Zool., I, Rept., p. 90 (type-locality, Philippines; types in Vienna Mus.).

1905. *Anisodon lilljeborgi* ROSÉN, Ann. Mag. Nat. Hist. (7), XV, p. 176, pl. XI, fig. 3 (type-locality, Tjibodas, Java; types in Lund Mus.; Hj. Moeller, collector).

Description (figs. 317–319).—*Adult female;* Brit. Mus. No. 94. 1. 25. 9.; near Taiwan fu, Formosa; Holst, collector. Rostral higher than wide, visible from above; internasals small, only one-third the size of the prefrontals, nearly triangular; prefrontals very large, broadly in contact with preocular and loreal; frontal small, narrow, urceolate, the posterior outline rounded, the lateral sutures greatly concave; supraoculars excessively large, much larger than frontal, very broadly in contact with prefrontals; parietals large, the suture between them longer than the frontal; nostril a round hole in the middle of a single nasal; canthus rostralis sharp, overhanging the very concave loreal region; a small lozenge-shaped loreal; a single, large, concave preocular; three postoculars; temporals 2+(1 small)+3, the lower anterior on left side coalesced with supralabial; mouth very deeply cleft, with 8 supralabials, first long, in contact with loreal, 4, 5, and 6 in contact with eye; 8 lower labials, 3 in contact with first pair of chin-shields, of which there are three pairs; scales smooth, without pits, in 17 rows; ventrals 175;[a] anal single; subcaudals 60.[a] Color (in alcohol) brownish gray densely spotted with dusky and pale ochraceous, forming a very obscure pattern; a dark narrow band from tip of snout to posterior end of frontal, followed by a V-shaped mark, the opening resting on the upper edge of the preoculars, the apex on the posterior end of the interparietal suture; a similar band, from upper postocular along outer edge of parietal; all the bands on the head composed of narrower dusky lines with a pale line between them; from apex of parietal V a solid dark line along the median line of the upper neck; an obscure dusky transocular band; underside brownish gray with two narrow dusky lines, one on each side of the median line; the grayish ground color is produced by innumerable dusky specks powdered all over the surface.

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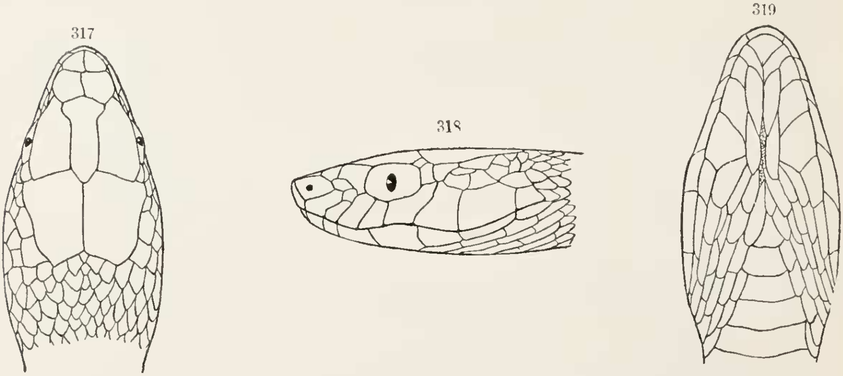
[a] From *ψάμμος*, sand; *δυνάστης*, lord, ruler.

[b] Signifying dusty.



Figs. 317-319.—Psammodynastes pulverulentus. 2 × nat. size. 317, top of head; 318, side of head; 319, underside of head. No. 34707, U.S.N.M.

Dimensions.

	mm.
Total length	382
Snout to vent	313
Vent to tip of tail	69

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[a] According to Boulenger (MS.).

Variation.—The lateral head-shields are subject to considerable variation. Thus there is often a second loreal underneath the ordinary one; the temporals are more or less irregular in many instances; the number of preoculars is sometimes two, while the postoculars vary between two and four. In a large series of specimens from the whole range of the species the minima and maxima of the ventrals have been found to be 146 and 175, the latter in the Formosa specimen described above, and of the subcaudals respectively 44 and 66.

The coloration is very variable, especially the ground color, which varies from nearly uniform raw umber to nearly blackish, with intermediate shades spotted with darker and paler in great profusion.

Habitat.—Widely distributed from the eastern Himalayas to the Malay peninsula and archipelago, Indo-China, Philippine Islands, and Formosa.

The only record of its occurrence in the latter island is the female specimen in the British Museum, collected by Mr. Holst at Taiwan fu, and described above. I owe the opportunity to make this description to the kindness of Doctor Boulenger.

As yet *Psammodynastes pulverulentus* has not been recorded from the mainland of China and would thus appear to be an exception to the rule that the Formosan snakes have reached that island from China. On the other hand, its wide distribution in the Philippine Archipelago might tempt one to conclude that this species had arrived in Formosa from the south. With our present defective knowledge of the herpetology of China, such a conclusion would be too hasty, however. It is moreover a significant fact that this snake is at home in the eastern Himalayas, and in the mountains of Assam and Burma, where so many other Formosan species, also occurring in China, have their nearest relatives and probable origin. There is every reason to believe that *P. pulverulentus* may yet be discovered in the mountains of southern and western China.

List of specimens of Psammodynastes pulverulentus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal	Subcaudals.	Temporals.	Supralabials.	Loreal.
Brit. Mus.	94.1.25.9	Female[a]	Near Taiwan fu, Formosa.	....	Mr. Holst	17	175	1	60	2+3	8	1
U. S. N. M.	23753	....do	Trong, Lower Siam.	1896. Sept. —	Dr. W. L. Abbott.	17	161	(?)	57	2+2	8	1
Do.	26220	....do	.....do		.....do	17	162	1	59	2+3	8	1
Do.	34707	Male[b]	Mount Apo, Mindanao, P. I.	1904. July	Dr. E. R. Mearns.	17	156	1	60	2+3	8	2
Do.	34708	....do	.....do	.....do	.....do	17	160	1	61	2+3	8	2
Do.	34769		.....do	July 9	.....do	17	163	1	55	2+3	8	2

[a] Description, p. 383.

[b] Figs. 317-319.

Family ELAPIDÆ.

This family contains all the so-called "proteroglyph" snakes, or snakes with a permanently erect grooved poison fang in the anterior portion of the horizontal maxillary bone.

The members of the family are divided into two subfamilies, one containing the terrestrial species which have retained the general physiognomy of the majority of snakes, the other embracing forms which have become strongly modified for marine life, as follows:

a[1] Tail cylindric..Elapinæ, p. 386.
a[2] Tail strongly compressed, oar-shaped........................Hydrinæ p. 400.

Subfamily ELAPINÆ.

As stated above, the general physiognomy of these snakes is that of the great majority of snakes, the *Natricidæ*, and the resemblance of some of the species in each family is so complete as to have deceived experts on a superficial examination. The generally small eye with vertical pupil, frequent absence of a loreal, and even width of head with body will serve to characterize many of the Elapines, but the presence of the poison fang is the only reliable criterion.

It is the more to be regretted that these snakes can not be readily and at a glance distinguished from the numerous harmless species, as they are the deadliest and often the most dangerous of all snakes. Thus the Indian cobra, found in Formosa, and the so-called hamadryad belong to this subfamily. The "krait,". which grows to be over 4 feet, and which is represented by a separate form in Formosa (*Bungarus multicinctus*) is also very destructive of life where it is common. On the other hand, the smaller species, although their poison in proportion is equally deadly, are not very dangerous to man, partly because of the smallness of their mouths, partly, it seems, because of the supposed gentleness of some of them.

The Elapine snakes are truly tropical in their distribution. Only one genus, *Elaps*, occurs in America, while on the other hand the majority of the Australian snakes belong to this family.

Only four species, belonging to four genera, come within our limits, viz, three in Formosa and one in the Riu Kius, although it would not be surprising if additional species were discovered in the former island.

They may be distinguished as follows:

KEY TO THE FORMOSAN AND RIU KIUAN GENERA.

a[1] Median dorsal scale row not enlarged; subcaudals all, or mostly, in pairs.
  b[1] Neck not dilatable, not surrounded by more scale rows than middle of body; internasal not bordering the nostril.
    c[1] One to three small teeth on maxillary behind fangs......*Hemibungarus*, p. 387.
    c[2] No teeth on maxillary behind fangs......................*Calliophis*, p. 391.
  b[2] Neck dilatable; more scale rows around neck than around middle of body; internasal bordering the nostril.................................*Naja*, p. 394.
a[2] Median dorsal scale row enlarged; subcaudals single............*Bungarus*, p. 397.

Genus HEMIBUNGARUS[a] Peters.

1843. *Brachyrhynchus* FITZINGER, Syst. Rept., p. 28 (type, *Elaps calligaster*) (not of LAPORTE, 1833).

1862. *Hemibungarus* PETERS, Mon. Ber. Berlin Akad. Wiss., 1862, p. 637 (type, *Elaps calligaster*).

The only difference between the genera *Hemibungarus* and *Calliophis* appears to be the presence of several (1–3) small solid teeth on the maxillary bone behind the grooved fang in the former, and it is questionable whether these so-called genera really represent genetic groups. The two species occurring within our limits, namely, *Calliophis macclellandii* in Formosa and *Hemibungarus japonicus* in the Riu Kiu Islands seem to be so closely related to each other that the latter appears less nearly allied to any of the other species of *Hemibungarus*. The only difference, besides that of dentition, consists in the greater length of the parietals in *H. japonicus* and in a slightly different pattern of coloration. Thus far no *Hemibungarus* has been recorded from Formosa, but this island is as yet so imperfectly known that no conclusion can be based on this fact.

The relationship of these snakes (through *Calliophis*) is undoubtedly Himalayo-Chinese, but beyond this statement it would be hazardous to generalize for the present.

The two forms described in the following pages under the names of *H. japonicus* and *H. boettgeri* are evidently very closely allied in spite of their very different coloration. The scutellation is almost identical, though it must be pointed out that in the former (9 specimens) the number of ventrals averages higher, namely, 208.5 (maximum 216, minimum 196), the corresponding figures for the latter (11 specimens) being 193.5 (204 and 183). While the scale formulas thus show some overlapping, the difference in coloration is so striking and apparently so constant, without any intermediary specimens, that I do not feel compelled to use trinominals for these forms, especially in view of their geographical isolation, the former being confined to the O-shima subgroup, the latter to the Okinawa subgroup of the Riu Kiu Archipelago.

They may be distinguished as follows:

a^1 Red (white in alcohol) with one, or three, narrow dark-brown longitudinal stripes, and distant rings of the same color; ventrals 196 to 216 ...... *H. japonicus*, p. 387.

a^2 Black, with four narrow longitudinal red stripes (whitish in alcohol) on back, and distant white half-rings; ventrals 184 to 200 .... *H. boettgeri*, p. 389.

HEMIBUNGARUS JAPONICUS[b] (Guenther).

HAI (according to Dr. Ijima).

1868. *Callophis japonicus* GUENTHER, Ann. Mag. Nat. Hist. (4), I, 1868, p. 428, pl. XVII, fig. *c* (type-locality, Nagasaki [?]; type in Brit Mus.; Whitely, collector).—*Hemibungarus japonicus* BOULENGER, Cat. Snakes Brit. Mus., III, 1896, p. 395 (part: Oo-shima).—WALL, Proc. Zool. Soc. London, 1905, II, p. 515 (part: Amami-o-shima).

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[a] From ἡμι-, half-; and *Bungarus*, a nearly related genus of snakes.

[b] Signifying Japanese.

Description.—Young: U.S.N.M. No. 31817; Amami-o-shima, Riu Kiu Archipelago; Dr. H. M. Smith collection. Rostral broader than high, easily visible from above; internasals broader than long, the suture between them scarcely more than one-half that between the prefrontals which are broadly in contact with supraoculars; frontal longer than its distance from tip of snout and than interparietal suture, much broader than supraoculars; parietals very long, longer than frontal; nostril large, round, at the posterior margin of the anterior nostril, which is larger than the posterior and in contact with second supralabial; no loreal; a single preocular situated above the center of the eye in contact with posterior nasal; eye rather large, the diameter greater than its distance from edge of lip; two postoculars; temporals 1 + 1, second one very large; a large shield bordering the outer posterior half of parietal; 7 supralabials, sixth and seventh largest, third rather high, third and fourth entering eye; four lower labials in contact with anterior chin-shields which are as long as the posterior, fourth lower labial very large; 13 rows of smooth scales without apical pits; 196 ventrals; anal divided; 31 pairs of subcaudals. Color (in alcohol) pale cream-color (in life said to be red) with a narrow dark-brown median line, one scale wide, from frontal to tip of tail; 16 dark-brown rings around the body and tail, about 3 scales broad on back and two ventrals broad below, the intervals between them about three to four times as wide; top of head dark brown except the median portion of each parietal, the brown color on the sides of the head extending some distance past the last supralabial; on the underside a large, roundish blotch of dark brown extending over four ventrals between the rings.

Dimensions.

	mm.
Total length	221
Snout to vent	200
Vent to tip of tail	21

Judging from the *adult female* in British Museum, the full-grown specimens do not differ essentially from the young described above.

Variation.—The scutellation seems to be very constant, though the ventrals range between 196 and 216 in the nine specimens recorded. The subcaudals on the other hand only vary between 28 and 31 pairs.

The coloration is also rather constant, except that some specimens, for instance the type and the young specimen in British Museum, collected by M. Ferrié, have an additional dark-brown stripe along each side of the body. Its presence is not a sign of youth as shown by the specimen described above. The number of rings around the body varies slightly; thus in the specimen in the Imperial Museum in Ueno Park, Tokyo, there are 12 rings on the body, one at the vent and one on tail. In this specimen the dark bands on the back are plainly edged with whitish.

Since the above was written Doctor Wall has reported upon four specimens from Amami-o-shima, obtained by Mr. Owston's collectors. Of these two agreed in having three longitudinal dorsal black lines narrower than the white intervals. One of these had indications of another line in the flanks on each side. One had 12 and the other 14 black annuli. The ventrals and subcaudals were 208+29 and 198+28. Two others were pale pink with a single, narrow, vertebral black line. One of these had 15 and the other 13 black annuli, and the ventrals and subcaudals were 215+28 and 214+30.

Habitat.—This form appears to be restricted to the O-shima subgroup of the Riu Kiu Archipelago, inasmuch as all the specimens supplied with exact data have been taken in "Oo-shima," or as we prefer to call it, Amami-o-shima, in order to avoid confusion with the many other O-shimas.

Whitely's specimen, upon which Guenther founded the species, was said to have come from Nagasaki. We know now that all his specimens credited to that locality came from other places, the present one almost certainly from Amami-o-shima.[a]

List of specimens of Hemibungarus japonicus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
Brit. Mus.	*a*	Young.[a]	"Nagasaki" [error].	....	Whitely	13	205	2	29	....	....	7
Do	*d*	....do.[a]	Amami-o-shima	....	Ferrié	13	211	2	28	....	....	....
Do	*c*	Male[a]	....do	....	....do	13	216	2	28	....	....	....
Imper. Tokyo.	24	Young	....do	....	....	13	214	2	28	1,2	1+1	7
U.S.N.M.	31817	....do.[b]	....do	....	H. M. Smith	13	196	2	31	1,2	1+1	7

[a] Type. [b] Description, p. 388.

HEMIBUNGARUS BOETTGERI[b] (Fritze).

HAI (according to Dr. Ijima).

1892. *Callophis japonicus* Boulenger, Ann. Mag. Nat. Hist. (6), X, Oct. 1892, p. 302 (Okinawa) (not of Guenther).—Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895. p. 115 (Okinawa).—*Hemibungarus japonicus* Boulenger, Cat. Snakes Brit. Mus., III, 1896, p. 395 (part: Okinawa).—Boettger, Kat. Schl. Mus. Senckenberg., 1898. p. 123 (Okinawa).—Wall, Proc. Zool. Soc. London, 1905, II, p. 515 (part: Okinawa).

1894. *Callophis boettgeri* Fritze, Zool. Jahrb. Syst., VII, p. 861; author's separate p. 12 (type-locality, Tokuchimura, Okinawa shima; type in Mus. Senckenberg.; Fritze, collector).—Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 115 (Okinawa).

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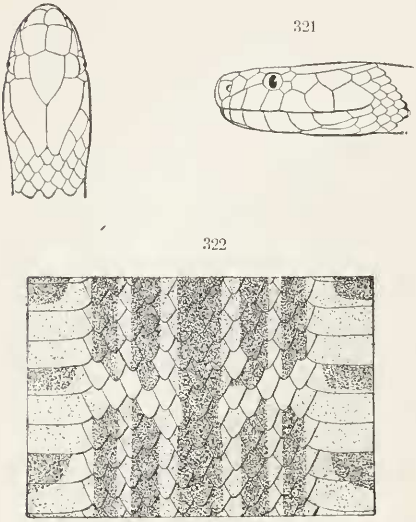
[a] Boulenger, Cat. Sn. Brit. Mus., III, p. 395, foot note, has already intimated that this specimen may have come from Riu Kiu.

[b] For Dr. Oscar Boettger, the distinguished herpetologist and malacologist of Museum Senckenbergianum, in Frankfurt am Main.

Description.—Adult female; Fifth Higher Middle School collection, Kumamoto, No. B 25; Okinawa shima, Riu Kiu archipelago; 1891 (figs. 320–322). Rostral broader than high; frontal longer than its distance from end of snout; parietals very long, as long as frontal and prefrontals together, and more than twice the distance from frontal to rostral; one preocular; two postoculars; temporals 1 + 1; 7 supralabials, third and fourth entering eye; 4 lower labials in contact with anterior chin-shields; 13 scale rows; ventrals 193; anal divided; subcaudals 29 pairs. Color (in alcohol) above iridescent blackish blue with four longitudinal light bands, the two median bands being apparently reddish, the two outer ones white, the former commencing on inner anterior corner of parietals and continuing to end of tail, the latter beginning on sides of neck and ending on sides in front of anus; across this longitudinal pattern there is a transverse one consisting of about fourteen (of which one on the tail) irregular cross bands of bluish black, edged with white, more or less interrupted by the longitudinal stripes so as to form two superimposed ocelli; these black cross bands are carried across the belly on a single ventral; underside whitish with numerous large and irregular blackish blue blotches; labials of both jaws mottled light and blackish.



Figs. 320–322.—Hemibungarus boettgeri. 2½ × nat. size. 320, top of head; 321, side of head. Enlarged. 322, color pattern around middle of body. No. B25, High School, Kumamoto.

Dimensions.

	mm.
Total length	518
Snout to vent	474
Vent to tip of tail	44

Variation.—With the exception of one specimen having 8 supralabials on one side, the head-shields show no noteworthy variation. In the specimens recorded the ventrals range between 183 and 204, the subcaudals between 27 and 30 only.

The coloration is also very constant. The only variation is a slight one in the number of the cross bands. Thus Science College Museum No. 3 has only 8 complete bands on body, while No. 25 in the Imperial Museum, Tokyo, has 10, both having one at the vent and one on tail.

Doctor Wall, since the above was written, has reported upon six specimens obtained in Okinawa by Owston's collectors, and states that they were all alike in having five longitudinal black dorsal lines broader than the pink intervals. There were 9–12 narrow black annuli around the body and 1–2 (2 usually) on the tail. The ventrals and subcaudals are 204+28, 183+28, 194+30, 202+?, 197+27, 129 [192?]+29.

Habitat.—This richly and uniquely colored form seems to be confined to the middle group of the Riu Kiu archipelago, inasmuch as all the specimens of which we have detailed record are from Okinawa shima or "Great Loo Choo." Doctor Fritze collected the type on the west side of that island.

List of specimens of Hemibungarus boettgeri.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
Senckenberg.	9395a	Adult[a].	Okinawa shima	1891. Aug. 5	Doctor Fritz	13	184	2	30	1,2	1+2	7
Imper. Tokyo	25		"Riu Kiu"			13	200	2	28	....	....	7
Sci. Coll. Tokyo.	3		Okinawa shima			13	192	2	30	....	....	7–8
Kumamoto School.	B 25	Female[b]	do	1891		13	193	2	29	1,2	1+1	7
Brit. Mus.	9.9.3-14	Male	do		P. Holst	13	190	2	28	....	....	....

[a] Type.

[b] Description p. 390; figs. 320–322.

Genus CALLIOPHIS[a] Gray.

1834. *Calliophis* Gray, Indian Zool., II, (C. fig.) (type, *C. gracilis*).
1859. *Callophis* Guenther, Proc. Zool. Soc. London, 1859, p. 81 (emendation).

With regard to the genetic relationship of the snakes at present embraced in this genus it is sufficient to refer to the remarks under *Hemibungarus* (p. 387).

Calliophis univirgatus occupies the eastern Himalayas, being represented farther east, in Burma and South China, by *C. macclellandii*. Two species inhabit the mountains in southern India, one the eastern Indian peninsula, from Burma to Cochin China, while one occupies the Malay peninsula and Sumatra.

CALLIOPHIS MACCLELLANDII[b] (Reinhardt).

1844. *Elaps macclellandii* Reinhardt, Calcutta Journ. Nat. Hist., IV (p. 532) (type-locality, Assam; type in Mus. Copenhagen).—*Callophis macclellandii* Guenther, Rept. Brit. India, p. 349 (part: var. γ, Assam).—Boulenger, Fauna Brit. India, Rept., 1890, p. 385 (part: Assam; Burma;

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[a] From κάλλος, beauty; ὄφις, snake.

[b] Named in honor of Dr. John McClelland, then editor of the Calcutta Journal of Natural History, who presented the type to the Royal Museum in Copenhagen. McClelland is the author of a large number of papers on Indian paleontology and ichthyology.

Southern China); Cat. Sn. Brit. Mus., III, 1896, p. 399 (part: forma *typica*, Assam; Pegu; Formosa; South China); Proc. Zool. Soc. London, 1899, p. 166 (Kuatun, Fokien, China).

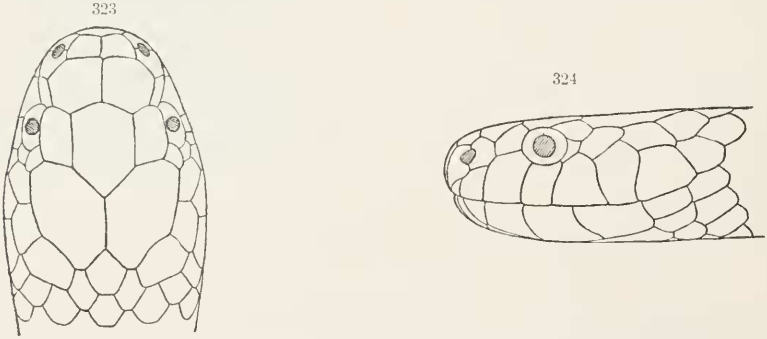
1854. *Elaps personatus* Blyth, Journ. Assiat. Soc. Bengal, XXIII, no. 3, p. 298 (type-locality, Assam).

1861. *Elaps macclellandi* Reinhardt, Vid. Meddel. Naturh., For. Kjoebenhavn, 1860, p. 247 (part: Assam).

1864. *Callophis annularis* Guenther, Rept. Brit. India, p. 350, pl. xxiv, fig. i (type-locality, "India").[a]

Calliophis univirgatus,[b] which is said to differ only in coloration, having a narrow black line down the middle of the back and no regular dorsal crossbars, is the western representative of the present species. It inhabits Sikkim and Nepal, apparently to the exclusion of typical *C. macclellandii*.

Description (figs. 323–324).—*Adult male;* British Museum; Formosa; R. Swinhoe, collector. Rostral barely visible from above; internasals nearly entering nostrils; nostril in posterior edge of a large nasal, followed by a somewhat smaller postnasal; prefrontals large, broadly in contact with supraoculars; frontal about as long as its distance from tip of snout, slightly shorter than parietals; one large preocular in contact with postnasal, prefrontal, supraocular, and third supralabial; two postoculars; temporals 1 + 1; 7 supralabials, third and fourth entering eye, first small, third large, as large



Figs. 323–324.—Calliophis macclellandii. (From Boulenger, Fauna Brit. India, Rept., p. 383.) 323, top of head; 324, side of head.

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[a] In Boulenger's catalogue (III, p. 399) it is stated that the type in British Museum is from South China and presented by Mr. J. C. Bowring.

[b] 1858. *Elaps univirgatus* Guenther, Cat. Col. Sn. Brit. Mus., p. 231 (type-locality, Nepal; types in British Museum; Hodgson, collector).—*Callophis univirgata* Guenther, Proc. Zool. Soc. London, 1859 (p. 83, pl. xvii Nepal).

1861. *Elaps macclellandi* Reinhardt, Vid. Meddel. Naturh. For. Kjoebenhavn, 1860, p. 247 (part: Darjeeling).

1861. *Callophis macclellandii* Guenther, Proc Zool. Soc. London, 1861, p. 219 (Nepal).

1896. *Callophis macclellandii* var. *univirgatus* Boulenger, Cat. Sn. Brit. Mus., III, p. 399 (Nepal; Darjeeling).

as sixth; 6 lower labials, four in contact with anterior chin-shields, fourth very large; posterior chin-shields about as large as anterior; 13 rows of smooth scales; 240 ventrals[a]; anal divided; 34 pairs of subcaudals.[a] Color (in alcohol) above dull reddish gray, with 31 yellow-edged black rings on the body and 4 on the tail, the bands being one scale wide on the back and two ventrals wide on the underside; halfway between the rings on the back two black spots about 5 scales apart to within 4 rings from the vent, and on the underside a single rounded large black blotch on the median line; a black collar about three scales wide just back of temporals and including the extreme posterior angle of the parietals; another black band from edge of lip through eye and involving anterior third of frontal and the prefrontals; snout in front of this band, as well as the rest of the head between the two black bands yellow.

Dimensions.

	mm.
Total length	400
Snout to vent	363
Vent to tip of tail	37

Variation.—The only feature worthy of notice is the great range in the number of ventrals, as shown by the Indian and Chinese specimens in British Museum, the extremes being 182 and 240. It should be noted, however, that the latter figure is that of the only specimen thus far recorded from Formosa, and that there is a wide gap between it and the other specimens in this respect. It is not beyond the bounds of probability that the Formosan specimen may represent a separate form characterized by a greater number of ventrals.

Habitat.—Extending from Assam and Burma in the west to southern China and Formosa in the east. It is recorded from the mountains north of Kiukiang, and also from high altitudes (3,000 to 4,000 feet) in the province of Fokien.

A single specimen collected by Swinhoe and now in the British Museum is known from Formosa.

List of specimens of Calliophis macclellandii.

Brit. Mus. No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.
d	Male [a]	Formosa		R. Swinhoe	13	240	2	34
c	Half grown [b]	Kiukiang Mountains, China		A. E. Pratt	13	215	2	26
e	Male [b]	Southern China		J. C. Bowring	13	212	2	32
......	......do. [c]	Kuatun, Fokien		J. D. La Touche	13	193	2	36

[a] Description, p. 392. [b] Boulenger, Cat. III, p. 399. [c] Boulenger, Proc. Zool. Soc., 1899, p. 166.

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[a] According to Boulenger's count.

Genus NAJA[a] Laurenti.

1768. *Naja* LAURENTI, Synops. Rept., p. 90 (type, *Naja naja*).
1830. *Uræus* WAGLER, Nat. Syst. Amph., p. 173 (type, *Naja haje*).
1830. *Aspis* WAGLER, Nat. Syst. Amph., p. 173 (type, *Naja naja*) (not of Laurenti, 1768).
1831. *Tomyris* EICHWALD, Zool. Spec., III (p. 171) (type, *T. oriana*).
1836. *Hamadryas* CANTOR, Asiat. Research., XIX, p. 187 (type, *H. hannah*) (not of Huebner, 1806).
1843. *Dendraspis* FITZINGER, Syst. Rept., p. 28 (type, *N. bungarus*).
1858. *Pseudohaje* GUENTHER, Cat. Colubr. Snakes Brit. Mus., p. 222 (type, *P. nigra*).
1864. *Ophiophagus* GUENTHER, Rept. Brit. India, p. 340 (type, *O. elaps*).

One species of these deadly snakes occurs within our territory, inasmuch as the eastern representative of the terrible Indian cobra has been found in the extreme south of Formosa.

NAJA NAJA[b] ATRA[c] (Cantor).

1842. *Naja atra* CANTOR, Ann. Nat. Hist., IX, 1842, p. 482 (type-locality, Chusan, China).
1859. ?*Naja tripudians* var. *scopinucha* COPE, Proc. Phila. Acad., 1859, p. 343 (type-locality, Canton River; type in Mus. Acad. Phila.; Doctor Ruschenberger, collector).
1860. *Naja haji* HALLOWELL, Proc. Phila. Acad., 1860, p. 504 (Hongkong) (not *N. haje* (Linnæus)).
1866. *Naja tripudians* var. *atra* MARTENS, Preuss. Exped. Ost-Asien, Zool., I, p. 177 (Chusan Archipel.).
1867. *Naja lutescens* var. *larvata* STEINDACHNER, Novara Exped., Zool., 1, Rept. p. 84 (Hongkong) (not of Cantor).
1876. *Naja tripudians* var. *unicolor* MARTENS, Preuss. Exped. Ost-Asien, Zool., I, p. 382 (substitute name).
1885. *Naja tripudians* BŒTTGER, Offenbach. Ver. Naturk. 24-25 Ber., pp. 127, 154 (Canton) (not of Merrem); Ber. Senckenberg. Naturf. Ges., 1894, p. 134 (Hainan); p. 137 (Hongkong).—WALL, Proc. Zool Soc. London, 1903, p. 97 (Hongkong; Hainan).
1896. *Naia tripudians* var. *fasciata* (part) BOULENGER, Cat. Snakes Brit. Mus., III, p. 383 (Kiukiang; Canton; Hainan; Siam).—BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 121 (Canton; Hainan) (not of Gray?).
1896. *Naia tripudians* var. *sputatrix* (part) BOULENGER, Cat. Snakes Brit. Mus., III, p. 384 (Chusan Ids.) (not of Boie).

In treating of the association of subspecies constituting the species *Naia tripudians* (= *Naja naja*) Boulenger[d] has attempted a subdivision based chiefly upon color differences. A glance at the list of 71 specimens given by him, shows that the "subspecies," or "varieties," or "forms" thus distinguished are not correlated with geographical distribution. In view of Doctor Boulenger's statement that "the forms enumerated [by him] might be regarded as distinct species but for the absence of any sharp demarcation-lines between them," this lack of correlation might be explained. Nevertheless, even if we regard them as species, their geographical distribution becomes disconnected, confused, and unintelligible.

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[a] Said to be derived from *Nag*, the Indian word for snake.

[b] 1758. *Coluber naja* LINNÆUS, Syst. Nat., 10 ed., I, p. 221 (type-locality, India orientalis); 12 ed., I, 1766, p. 382.

[c] Signifying black.

[d] Cat. Snakes Brit. Mus., III, 1896, p. 381.

It seems that a better subdivision might have been obtained by taking the scale formula as a primary basis and color only as a secondary character.

It might then be possible to separate out a form *Naja naja oxiana* (Eichwald), from Transcaspia, Afghanistan, and Gilgit, characterized by a large number (averaging 268) of ventrals and caudals together, the sum of these giving more definite results than each separately, owing to the variable location of the vent.

The specimens from India proper, Ceylon, and possibly Burma and the Malay peninsula seem to be fairly well characterized by the large number of scales around the neck, 29 to 35, rarely 27, and should probably stand as *Naja naja*.

The cobras from the Malay Archipelago have about the same average number of ventrals plus caudals as the Indian cobras (235 in the former as against 238 in the latter), but the number of scales around the neck is smaller, viz, only 21 to 25. These may be Boie's *Naja naja sputatrix*, or they may fall into several more subspecies.

Finally, the Chinese and Siamese specimens seem to hold an intermediary position so far as neck scales are concerned, viz, 25 to 27, but with a minimum of ventrals plus caudals (average of 9 specimens 216.) These are also fairly uniform in color and appear entitled to the subspecific appellation *Naja naja atra* (Cantor).

The demarcation-lines here drawn up are not very sharp, but they seem better than those based primarily on color and have the advantage of a more rational geographic distribution than the others. Moreover, like Boulenger's scheme, this is only a provisional arrangement which needs to be tested with a very large material. In this connection I would earnestly warn against using specimens, to the origin of which there attaches the least suspicion. Only by utilizing material which in every detail is authentic and beyond dispute will it be possible to reach a satisfactory solution.

Description.—Young: British Museum, No. 99.4.24.102; South Cape, Formosa; J. D. La Touche, collector. Rostral very broad, the height only two-thirds of the width; internasals somewhat longer than prefrontals; frontal pentagonal, broader than supraoculars; parietals as long as frontal and prefrontals together; nostril separating the two large nasals; no loreal; one prefrontal in contact with supraocular, prefrontal, internasal, posterior nasal, and third supralabial; diameter of eye as large as its distance from anterior rim of nostril; two postoculars, upper much the larger; large temporals, 2 + 1; a large scale in the posterior angle between the parietals, and a larger one on each side of the parietals in continuation of the larger upper temporal; seven supralabials, third and fourth entering eye, third very high, broadly in contact with posterior nasal, fifth high, touching upper postocular; four lower labials in contact with anterior chin-shields which are larger than posterior pair; 25 scales round the neck, and 21 round the body;[a] 178 ventrals;[b] anal divided; 42 pairs of subcaudals.[a] Color (in alcohol) uniform blackish brown, except sides and lower part of head, as well as 16 anterior ventrals, which are whitish; on the upper neck a pair of white-rimmed "spectacles" and 13 very narrow yellowish cross lines, the anterior of which is faintly indicated on the ventrals also.

Dimensions.

	mm.
Total length	352
Snout to vent	304
Vent to tip of tail	48

As to how large the cobra grows to be in Formosa there is no information, but specimens from other localities are known to exceed 1½ meters in length.

Variation.—The species is subject to a considerable amount of variation as might be expected from its wide distribution. The more essential features of this have been touched upon in the preliminary remarks following the synomymy (see p. 394).

Distribution.—The species *Naja naja* has a wide distribution in southeastern Asia, from Transcaspia to the Philippines, but the present subspecies, as defined above, seems to be confined to China south of Shanghai, including Hainan, French Indo-China, continental Siam, and Formosa.

Its occurrence in Formosa is now demonstrated by a young specimen in British Museum collected near South Cape by Mr. J. D. La Touche. I owe the opportunity to examine and describe this specimen to the courtesy of Dr. G. A. Boulenger.

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[a] According to Boulenger's count.

List of specimens of Naja naja atra.

Museum.	Number.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows, neck.	Scale rows, body.	Ventrals.	Subcaudals.	Ventrals plus subcaudals.
U.S.N.M.	7517	Female	Hongkong, China	1854. May —	W. Stimpson	27	21	170	45	215
Brit. Mus.	99.4.24.102	Young[a]	South Cape, Formosa.	....	J. D. La Touche.	25	21	178	42	220
Do.	*Da*	Male[b]	Chusan Islands	....	J. J. Walker	25	21	167	....	....
Do.	*Db*	Young[b]	China	....	R. Lindsay	25	21	177	47	224
Do.	*Cba*	Female[c]	Kiukiang, China	....	J. Walley	25	21	166	48	214
Do.	*Cbb*	....do.[c]	Canton	....	....	25	21	170	....	....
Do.	*Cbc*	....do.[c]	Hainan Island	....	J. Neumann	25	21	168	43	211
Senckenberg.	9383*a*	Adult[d]	Canton	....	O. Fr. v. Moellendorff.	(*e*)	21	162	47	209
Do.	9383*b*	....do.[d]	....do	....	....do	(*e*)	21	164	50	214
(?)	....	(*d*)	....do	....	....do	(*e*)	21	165	....	....
(?)	....	(*d*)	....do	....	....do	(*e*)	21	169	....	....
Brit. Mus.	*Cbd*	Male[c]	Siam	....	....	27	21	170	48	218
Do.	*Cbe*	Female[c]	....do	....	....	27	21	174	47	221

[a] Description, p. 395.
[b] Boulenger, Cat. III, p. 384.
[c] Boulenger, Cat. III, p. 383.
[d] Boettger, 1885, p. 127.
[e] 25 to 27 scale rows round the neck, Boettger, *l. c.*

Genus BUNGARUS[a] Daudin.

1803. *Bungarus* DAUDIN, Bull. Soc. Philom. Paris, III, No. 72, March, 1803, p. 187 (type, *B. fasciatus*).

1811. *Pseudo-boa* OPPEL, Ordn. Rept., p. 68 (type, *B. fasciatus*) (not of Schneider, 1801).

1828. *Aspidoclonion* WAGLER, Icon. Amph., I, fol. 2 (type, *A. semifasciatum*).

BUNGARUS MULTICINCTUS[b] Blyth.

1858. *Bungarus semifasciatus* GUENTHER, Cat. Col. Snakes Brit. Mus., p. 221 (China) (not of Boie, 1827); Rept. Brit. India, 1864, p. 344 (China; Formosa).—SWINHOE, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225 (Formosa; Amoy, China).—BOETTGER, Offenbach. Ver. Naturk. 24–25 Ber., 1885, p. 128 (Canton).

1861. *Bungarus multicinctus* BLYTH, Journ. Asiat. Soc. Bengal, XXIX, p. 98 (type-locality, Formosa; type in Calcutta Mus.; Swinhoe, collector).—BOETTGER, Offenbach. Ver. Naturk. 26–28 Ber., 1888, pp. 86, 148 (South China; Formosa).—STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 222 (Taipa, Formosa).

1896. *Bungarus candidus* var. *multicinctus* BOULENGER, Cat. Sn. Brit. Mus., III, p. 369 (China; Formosa; Burma); Proc. Zool. Soc. London, 1899, p. 164 (Kuatun, Fokien, China).—*Bungarus candidus* var. *multicincta* BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 119 (Canton).

Three closely-related forms of the "Krait" differing in color but apparently occupying distinct geographic areas are united by Boulenger under the oldest name, *B. candidus*. The typical form seems to be confined to islands in the Malayan Archipelago; another, var. *cæruleus*, extends over entire India (exclusive of the Himalayas and Ceylon) and the Malay Peninsula; the third, the one here treated of, is recorded from Toungoo, in lower Burma, not far from the Karennee Hills, and from various localities in southern China. The first is considered most distinct, and there seems to be no good reason for connecting it nomenclaturally with our Chinese form. Of the Indian tropical form Boulenger says that it is "almost completely connected" with *B. multicinctus*. This "almost" only prevents me at present from speaking of the latter as *Bungarus cæruleus multicinctus*.

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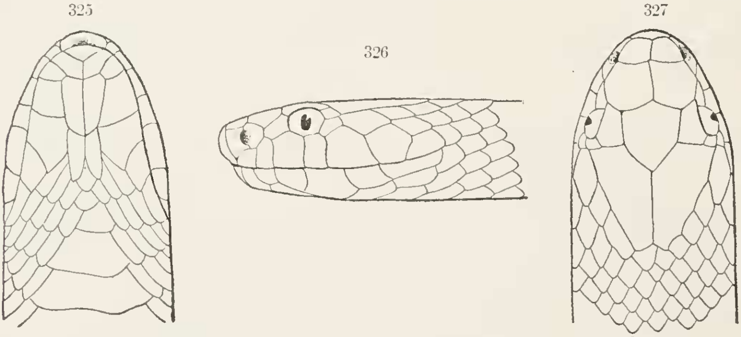
[a] Derived from "Bungarum-pamah," which according to Russell's "Indian Serpents" is the vernacular name for *B. fasciatus* on the coast of Coromandel, India.
[b] Signifying many-belted, i. e., with many crossbars.

Another very closely allied form, differing chiefly in the less-pronounced enlargement of the median dorsal scale row, *B. lividus*, inhabits Assam. The Ceylon krait *B. ceylonicus*, is another nearly related form.

Description.—Adult male: Science College Museum, Tokyo, No. 15; Taipa, Formosa; November, 1897; T. Tada, collector (figs. 325–327). Rostral broader than high; visible from above; internasals,



FIGS. 325–327.—BUNGARUS MULTICINCTUS. NAT. SIZE. 325, UNDERSIDE OF HEAD; 326, SIDE OF HEAD; 327, TOP OF HEAD. NO. 15, SCI. COLL. TOKYO.

broader than long, half as large as prefrontals which are broadly in contact with supraoculars; frontal as long as its distance from tip of snout and interparietal suture twice as wide as supraoculars at center of eye; parietals much longer than frontal, nearly as long as their distance from tip of snout; nostril large, vertically elliptic, between two nasals, the posterior narrowed behind so as to meet the preocular in a very short suture; no loreal; one long preocular, anteriorly in narrow contact with posterior nasal; eye rather small, its vertical diameter shorter than its distance from edge of lip; two postoculars; temporals 1 + 2; seven supralabials, last three largest, second in contact with preocular, third and fourth entering eye; four lower labials in contact with anterior chin-shields which are longer than the posterior pair; 15 rows of smooth scales, without apical pits, the median row greatly enlarged, more than twice as large as the other dorsals; 210 ventrals;

anal entire; 46 undivided subcaudals. Color (in alcohol) above dark seal brown with 45 narrow whitish cross lines or bars, 31 on the body and 14 on the tail, about one scale wide on the back, widening near the belly so as to equal two of the outer scale rows, the light-colored lateral scales often with a median dark line; head uniform dark, somewhat paler on labials; underside whitish more or less clouded with brown, and the dark brown of the sides descending on the body over the ends of the corresponding ventrals, while forming continuous, though somewhat irregular, rings on the tail.

Dimensions.

	mm.
Total length	860
Snout to vent	743
Vent to tip of tail	117

The *young* (U.S.N.M. No. 36514) is essentially like the adult described above, but has a whitish crescentic mark on each side of the neck behind the head.

This species reaches a length of more than a meter.

Variation.—The scale formula varies but little though 1+1 temporals occur besides 1+2. The ventrals vary in this form between 198 and 221, the subcaudals between 44 and 52.

The variation in coloration has reference chiefly to the number of white cross lines. Thus, the adult described above has 45, and the young 51 (40 on body 11 on tail), while as many as 60 have been recorded.

Habitat.—Southern China, from the provinces of Kiangsi and Fokien to Kwangtung and Kwangsi. Farther west it has been collected at Toungoo in Lower Burma, by Mr. E. W. Oates.

In Formosa it was first found by Swinhoe, and Mr. Tashiro has since informed us that it is found both in the northern and southern part of the island. He states that it was common around Taipa, whence he brought two specimens.

List of specimens of Bungarus multicinctus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
U.S.N.M.	36514	Young [a]	Taihoku (Taipa), Formosa.	1897. Sept. —	T. Tada	15	210	1	48	1,2	1+2	7
Sci. Coll., Tokyo.	15	Male [b]	Taipa, Formosa	do	do	15	210	1	46	1,2	1+2	7
Brit. Mus.	Bc	Female [c]	Formosa		R. Swinhoe	15	207	1	46			

[a] Sci. Coll. No. 3.

[b] Figs. 325-327; description, p. 398.

[c] Boulenger. Cat. III, p. 369.

Subfamily HYDRINÆ.

The high, compressed tail, shaped like the blade of an oar, distinguishes these snakes at once from all others and stamps them as inhabitants of the water. As a matter of fact these snakes are not only aquatic, but truly marine, some of them to an extent that renders it correct to designate them as pelagic.

Not only has the shape of the tail become specialized in these snakes, but the whole body is strongly compressed in some; in others the general shape has been greatly modified, so that the whole posterior portion of the body is abnormally enlarged while the front part is drawn out into an excessively elongated and narrow neck finished off with a small head not wider than the neck. Owing to the compressed form of the body the ventrals have been reduced in most of the forms to an extent which makes it difficult to recognize them as such. Even the scales of the body have become highly altered in many forms, being polygonal and juxtaposed with short keels or knobs or spines, sometimes in pairs, and totally unlike the scales of other snakes. That the nostrils are placed on top of the snout and provided with valves it is scarcely necessary to mention.

Not all the species are as greatly differentiated as above mentioned. A small group, the habits of which are still partly terrestrial, live near the shores and occasionally and temporarily climb among the rocks or even sometimes venture farther inland. These have still fairly well-developed ventrals to some extent fit for terrestrial locomotion, and their scales are imbricate. To this group belong the genera *Laticauda* and *Emydocephalus*.

Being "proteroglyph," all these marine snakes are poisonous. Nevertheless, several forms are perfectly harmless to man, such as the *Laticauda* occurring so frequently around the Riu Kiu Islands which the fishermen handle without fear and without accident.

The sea snakes, broadly speaking, inhabit all the tropical and subtropical seas outside of the Atlantic Ocean. In spite of much good work of late in this group, the species and their distribution are as yet but poorly understood. The lack of definite boundaries to their habitat and their liability to be carried beyond their natural limits by currents make it difficult to decide how many species to include in the present work. It has therefore been thought best to take cognizance of a few more species than have actually been recorded from the coasts of the territory covered by this work, when they are known to occur in the adjacent seas. Such species, however, have been included in brackets.

Doctor Boettger, in 1888 (Zool. Anz., pp. 395 seq.), published a paper on the external sexual characters of the sea snakes based upon an examination of 46 specimens belonging to two genera (*Distcira* and *Lapemis*), all from the Philippine Islands. He came to the conclusion that the males differ in having fewer ventrals, fewer scale rows around the neck, more anals, longer tail and smaller circumference of body relative to total length, and much more developed spines on the ventrals. In all three species examined by him he found a difference of about 20 ventrals between the maximum of the males and the minimum of the females. Thus in *Lapemis hardwickii* (*Hydrophis loreatus*) he found in the males 135–168 ventrals (average 153) and in the females 186–237 (average 202), the difference between the averages being 49 ventrals. His result was calculated to carry conviction as it was based upon a series of no less than 31 specimens. Nevertheless, if we inquire into the data furnished by Boulenger regarding the specimens of the same species in British Museum[a] we find in a much smaller series (14 specimens, 5 males and 9 females) proportions essentially different. In his list the ventrals of the males range between 130 and 155 (average 140), those of the females 136–200 (average 156), consequently an overlap of 19 ventrals instead of a gap of 18. The British Museum specimens are not from one locality, however, but cover the whole area from India to the Philippines, and it might be supposed that this discrepancy had a geographical significance. Such is not the case, however, for three females from Negros, Philippine Archipelago, consequently from practically the same locality as Boettger's specimens, have 140, 156, and 180 ventrals, respectively, thus nearly covering the whole range of Boettger's 18 males (135–168) without reaching the minimum of his 13 females (186).

These apparent discrepancies seem at present inexplicable, and indicate one of the many difficulties with which the student of these snakes has to deal.

My own observations bear out Boettger's conclusions only partly. In our four specimens of *Disteira godeffroyi* the female has more scale rows, more ventrals, and fewer subcaudals. On the other hand, in 20 specimens of *Disteira melanocephala* there is apparently no difference among the sexes except that the males average a few more subcaudals than the females.

KEY TO THE GENERA OF HYDRINÆ IN JAPANESE AND CHINESE WATERS.

a^1 Ventrals wide, at least four times as wide as long.
  b^1 Nasals widely separated by internasals; supralabials normal... *Laticauda*, p. 402.
  b^2 Nasals broadly in contact on median line of snout; middle supralabials fused into a large plate on each side .... *Emydocephalus*, p. 413.
a^2 Ventrals rudimentary, less than twice as wide as long.
  b^1 Two pairs of chin-shields, anterior always, posterior nearly always in contact. *Disteira*, p. 418.
  b^2 Chin-shields scarcely differentiated, not in contact.

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[a] Cat. Sn. Brit. Mus., III, p. 301.

c^1 Snout, from eye to tip shorter than width of head at posterior corner of supraoculars.
  d^1 Mental not concealed in a deep groove .... [*Lapemis*], p. 435.
  d^2 Mental concealed in a deep groove of the chin.......... [*Enhydrina*], p. 437.
c^2 Snout, from eye to tip equaling or longer than width of head at posterior corner of supraoculars.. *Hydrus*, p. 438.

Genus LATICAUDA[a] Laurenti.

1768. *Laticauda* LAURENTI, Syn. Rept., p. 109 (type, *L. scutata*).
1802. *Platurus* LATREILLE, Hist. Nat. Rept. IV, p. 183 (type, *P. fasciatus*).

Five species of this genus are provisionally recognized, of which *Laticauda muelleri*[b] seems to be a *L. laticaudata* with a ventral keel. A *Laticauda frontalis*[c] has recently been described as differing from *L. semifasciata* in having an undivided rostral and shield-like temporals.

Only two species are known with certainty to have been taken on the coasts of the territory covered by this work, but a third may be reasonably expected to occur and its characters are therefore given in conjunction with the others. They may be distinguished by the following:

KEY TO THE SPECIES OF LATICAUDA IN JAPANESE AND CHINESE SEAS.

a^1 Rostral undivided horizontally; belly without a median keel; two pairs of contiguous chin-shields; temporals 1+2; top of snout yellow.
  b^1 Scale rows 19; no unpaired shield between the prefrontals; upper lip dark brown. *L. laticaudata*, p. 402.
  b^2 Scale rows 21 to 25; normally an unpaired shield between the prefrontals; upper lip yellow.. [*L. colubrina*, p. 406.]
a^2 Rostral divided horizontally; belly with a median keel on posterior half; one pair of contiguous chin-shields; temporals 2+3; top of snout dark brown. *L. semifasciata*, p. 409.

LATICAUDA LATICAUDATA[d] (Linnæus).

1758. *Coluber laticaudatus* LINNÆUS, Syst. Nat., 10 ed., I, p. 222 (part: type-locality, the Indies; type in Mus. Stockholm); 12 ed., I, 1766, p. 383.—ANDERSSON, Bihang Svensk. Vet. Akad. Handl., XXIV, 1899, Pt. 4, no. 6, p. 18 (type).—*Platurus laticaudatus* GIRARD, Herpet. U. S. Expl. Exped., 1858, p. 180 (Fiji Is.).—PETERS, Mon. Ber. Berlin Akad. Wiss., 1877, p. 417 (part: Fiji, Tonga, Philippine Is.).—BOULENGER, Cat. Sn. Brit. Mus., III, 1896, p. 307 (Bay of Bengal to western Pacific; Loo Choo Islands).—WALL, Proc. Zool. Soc. London, 1903, pp. 96, 101 (Formosa; Loo Choo Islands); 1905, II, p. 517 (Okinawa).

1768. *Laticauda scutata* LAURENTI, Syn. Rept., p. 109 (substitute name for *C. laticaudatus* Linnæus).

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[a] From *latus*, broad; *cauda*, tail.

[b] *Platurus muelleri* BOULENGER, Cat. Sn. Brit. Mus., III, 1896, p. 309 (South Pacific).

[c] *Platurus frontalis* DE VIS, Ann. Queensland Mus., No. 6, 1905, p. 48 (New Guinea).

[d] From *latus*, broad; *caudatus*, tailed.

1802. *Platurus fasciatus* LATREILLE, Hist. Nat. Rept., IV, p. 185 (Indies).—FISCHER, Abh. Naturw. Ver. Hamburg, III, 1856, pp. 28, 70 (part: specim. Hamburg Mus., Indian Ocean).—HALLOWELL, Proc. Phila. Acad., 1860, p. 493 (Naha, Okinawa shima).—BOULENGER, Proc. Zool. Soc. London, 1887, p. 149 (Loo Choo Islands).

1817. *Platurus laurenti* RAFINESQUE, Amer. Month. Mag., I, p. 432 (substitute name; not of Daudin, 1803).

1836. *Coluber platycaudatus* OKEN, Allgem. Naturg., VIII, p. 566 (*lapsus*).

1858. *Platurus laticaudatus* var. GUENTHER, Cat. Colubr. Sn. Brit. Mus., p. 272 (New Guinea, Bengal, Siam, Van Diemen's Land).

1859. *Platurus fischeri* JAN, Rev. Mag. Zool., 1859 (p. 149); author's separate, p. 25, pl. D (type-locality, Indian Ocean; type in Mus. Milano); Icon. Ophid., livr. 40, 1872, pl. I, fig. 2 (type).—GUENTHER, Rept. Brit. India, 1864, p. 356, pl. XXV, fig. A (Bengal; Siam; New Guinea; New Hebrides).—ANDERSON, Proc. Zool. Soc. London, 1871, p. 189 (Calcutta).

1871. *Platurus affinis* ANDERSON, Proc. Zool. Soc. London, 1871, p. 190 (type-locality, Fallahs Mullah, Calcutta; type in Ind. Mus., Calcutta).

The *Coluber laticaudatus* of Linnæus (Syst. Nat., 10th and 12th editions) was based upon his account of the same species in Museum Adolphi Frederici, which was published in 1754 and not binominal. Two specimens were apparently described in that work. It now turns out from Andersson's examination of the types[a] that Linnæus had before him a specimen of each of the two species lately known as *Platurus laticaudatus* and *P. colubrinus*, the former with 19 scale rows, the latter with 23. His *C. laticaudatus* is consequently a composite species, and the application of the name by the first reviser who separated the component forms must stand.

The two species were steadily confounded by all authors, just as Linnæus had done, though under various names, such as *Platurus fasciatus* and *Hydrophis colubrinus*, until 1858, when Girard, for the first time (and not Peters in 1877, as occasionally stated), clearly separated, described, and named them. He tied the name *laticaudatus*, which had scarcely been used at all in the herpetological literature since the time of Linnæus, to the species with 19 scale rows, and applied *Hydrus colubrinus* of Schneider correctly to the other, this being the oldest name used for a specimen of the latter, though Schneider himself did not realize its distinctness from the Linnæan species, of which, as we have seen, in reality it only formed a part. Girard's nomenclature has been followed by nearly all subsequent writers.

The fact that Linnæus in the Systema Naturæ only gives the scale formula (i. e., number of ventrals and subcaudals) of the specimen with 23 scale rows (220–42) is not sufficient reason for fastening the name *C. laticaudatus* to the species represented by this specimen, in view of the above argument, and is, moreover, sufficiently set off by his reference to the plate in Museum Adolphi Frederici, which is said to represent the other specimen.

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[a] Bihang Svensk. Vet. Akad. Handl., XXIV, 1899, Pt. 4, No. 6, p. 18.

Whether the above synonymy includes one or more distinguishable forms may perhaps yet be open to question; at least I have not been able to fully make up my mind from our material which is entirely too insufficient, however. As far as it goes it seems to indicate two color forms. At least our specimens can be divided according to the following concurrent color characters, thus:

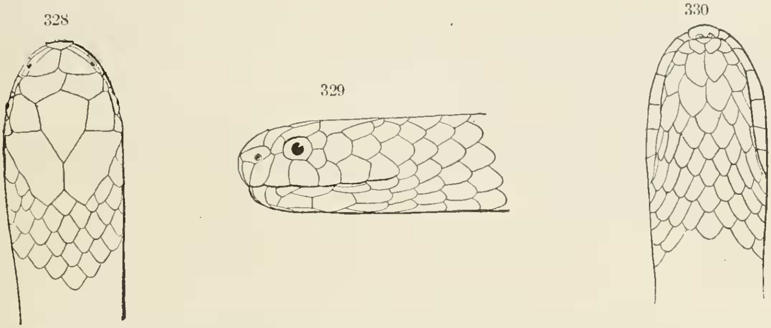
a^1 Light horseshoe-shaped mark on top of head bent down behind the eye, reaching the lip; none, or one, light ring on neck incomplete below; light rings on belly 4–5 ventrals wide .... *L. laticaudata* (Nos. 8994, Java; 29448. Nicobars).

a^2 Light horseshoe-shaped mark not bent down behind the eye; usually two light rings on neck incomplete below; light rings on belly 1–3 ventrals wide.
L. laticaudata affinis (Nos. 30761, Pulo Mansular, W. Sumatra; 7381, Riu Kius,; 21399, China Seas; 32669, Formosa; 33937–41, Riu Kius).

It should be noted that our eastern specimens belong to *L. affinis*, and it would be interesting to know to what extent the characters mentioned above hold good in a large series. In this connection it may be stated that the character of the incomplete light rings on the neck below is the least constant, as might be expected. It holds in seven of our nine specimens of *L. affinis*, but two of the Riu Kiu specimens (Nos. 33937 and 33939) have only one incomplete ring.

Since the above was written I have examined two specimens from Formosa in the Christiania Museum (No. 832) which in the main bear out the above.

Description (figs. 328–330).—*Adult male;* U.S.N.M. No. 32669; Formosa; 1894; Mr. Navara, collector. Rostral undivided, higher than broad, just visible from above; internasals broader than long, nearly triangular, their suture with rostral very short; prefrontals in contact throughout, anteriorly very broad with an acute outer angle descending on side of face between nasal and preocular without quite reaching the second supralabial, broadly in contact behind with supraocular; frontal long, pointed behind, much longer than distance from tip of snout; as long as parietals, broader than supraoculars; parietals short, not longer than frontal, the suture between them shorter than distance between frontal and rostral; nostril in the posterior half of an undivided nasal which is three times as long as high, slightly lower in front and narrowly in contact with preocular beneath the prefrontal; one preocular; eye small, its diameter less than its distance from edge of lip; 2 postoculars; temporals 1 + 2, slightly larger than the adjoining labials; 7 supralabials, first much wider above than below, third and fourth entering eye; mental very small, smaller than first lower labials; 7 lower labials, the last four exceedingly narrow, three anterior only in contact with anterior chin-shields which are somewhat smaller than the posterior, the latter broadly in contact; 19 rows of smooth scales without apical pits; 243 ventrals; anal divided; 47 pairs of subcaudals. Color (in alcohol) bluish gray above, yellowish underneath, with broad blackish brown rings around the body, there being 47 on neck and body and 5 on tail, the first on neck incomplete below; width of black rings above about four scale rows and about three ventrals underneath, the light interspaces respectively $2\frac{1}{2}$ above and 2 below; head blackish brown, rostral, snout, and eyebrow region as far as anterior angle of parietal and first temporal, yellow; labials brownish black as well as throat and lower neck, the latter with a median line of yellow.



FIGS. 328-330.—LATICAUDA LATICAUDATA. 2 × NAT. SIZE. 328, TOP OF HEAD; 329, SIDE OF HEAD; 330, UNDERSIDE OF HEAD. NO. 7381, U.S.N.M.

Dimensions.

	mm.
Total length	769
Snout to vent	659
Vent to tip of tail	110

The *female* and *young* are essentially like the above, the former somewhat larger with a shorter tail, No. 33937, for instance, our largest specimen, measuring 890 mm. with a tail 95 mm. long.

Variation.—The scale formula is fairly constant in this species, oculars, temporals, supralabials, and anal showing no deviation from the normal in a large series. In the specimens recorded from the waters adjacent to our territory the ventrals vary between 230 and 243, the subcaudals between 30 and 47.

As for the color variation of this species it is sufficient to refer to the preliminary remarks (on p. 404). The number of black rings on the body in ten specimens from Japanese waters ranges between 39 and 55.

Habitat.—Widely distributed along the coasts from India to the South Pacific islands and Tasmania. The species seems common about the Fijis and the Friendly Islands, and Fischer mentions a specimen from the Society Islands.

On the coasts of southeastern Asia it is not rare—for instance, in the Philippines—and to the north it has been found as far as Okinawa shima. A specimen from Naha, collected by Heine, of the Perry

Expedition, was recorded by Hallowell (U.S.N.M. No. 7381), and two specimens obtained by Pryer's collector, probably in the same island, are in British Museum. Two other specimens, also from Okinawa shima, are in the Imperial Museum, Ueno Park, Tokyo (Nos. 11, 12), as well as one from the Yaeyama group (No. 13). In the latter it must be common, for we have five specimens from Ishigaki shima through Mr. Owston, and British Museum has one from the same locality and collector through Doctor Wall. Similarly on the coasts of Formosa, whence I have examined two in the University Museum of Christiania, collected by Mr. Navara, and one from the same source in our own museum, obtained through the kindness of Prof. Robert Collett.

List of specimens of Laticauda laticaudata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom obtained.	Scale rows.	Ventrals.	Subcaudals.	Black rings on body.	Oculars.	Temporals.	Supralabials.
U.S.N.M.	7381	Young[a]	Naha, Okinawa shima.	1853. June —	W. Heine	19	232	45	55	1,2	1+2	7
Do	21399	do	China Sea (?)	....	....	19	242	43	48	1,2	1+2	7
Do	32699	Male[b]	Formosa	1894	Navara	19	243	47	46	1,2	1+2	7
Do	33937	Female	Ishigaki shima	1899. May-June	A. Owston	19	237	34	48	1,2	1+2	7
Do	33938	do	do	do	do	19	237	33	51	1,2	1+2	7
Do	33939	do	do	do	do	19	234	33	46	1,2	1+2	7
Do	33940	do	do	do	do	19	238	32	50	1,2	1+2	7
Do	33941	Male	do	do	do	19	238	38	45	1,2	1+2	7
Christiania.	832*a*	Young	Formosa	1894	Navara	19	235	44	39	....	....	....
Do	832*b*	Male	do	do	do	19	237	....	43	....	....	....
Brit. Mus.	*n*	....	Ishigaki shima.	....	Doctor Wall	19	230	41	....	....	....	....
Do	*c*	Female[c]	Loo Choo Islands.	....	H.J.S. Pryer	19	233	30	....	....	....	....
Do	*d*	Young[c]	do	....	do	19	232	31	....	....	....	....

[a] Figs. 328-330.

[b] Description, p. 404.

[c] Boulenger, Cat. III, p. 308.

[LATICAUDA COLUBRINA[a] (Linnæus).]

1758. *Coluber laticaudatus* LINNÆUS, Syst. Nat., 10 ed., I, p. 222 (part); 12 ed., I, 1766, p. 383.—*Platurus laticaudatus* PETERS, Mon. Ber. Berlin Akad. Wiss., 1877, p. 417 (part: Philippines; Amboina; Fiji Is.; New Hanover).

1799. *Hydrus colubrinus* SCHNEIDER, Hist. Amph., I, p. 238 (type-locality not stated; type, no. 9078, Berlin Mus.).—*Hydrophis colubrinus* SCHLEGEL, Phys. Serp., II, 1837, p. 514, pl. XVIII, figs. 21–22 (Moluccas, Timor, Celebes; China Sea).—*Platurus colubrinus* GIRARD, Herpet. U. S. Expl. Exped., 1858, p. 183 (Fiji and Tonga Is.).—BOULENGER, Cat. Sn. Brit. Mus., III, 1896, p. 308.—BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 114 (Philippines: Luzon, Cebu; Ternate; Tonga Tabu; Australia).—WALL, Proc. Zool. Soc. London, 1903, p. 101.

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[a] Signifying colubrine, like a *Coluber;* so named by Schneider because Linnæus had referred the species to that genus.

1803. *Ptaturus fasciatus* Daudin, Hist. Nat. Rept., VII, p. 226 (part), pl. lxxxv, fig. 1.—Jan, Icon. Ophid., livr. 40, 1872, pl. i, fig. 1 (New South Wales).

1847. *Laticauda scutata* Cantor, Journ. Asiat. Soc. Bengal, XVI (p. 1046) (not of Laurenti).—*Platurus scutatus* Guenther, Rept. Brit. India, 1864, p. 356 (Bay of Bengal to Chinese seas and New Zealand).

1856. *Platurus fasciatus* var. *colubrina* Fischer, Abh. Naturw. Ver. Hamburg, III, p. 30.

1858. *Platurus laticaudatus* var. b Guenther, Cat. Col. Sn. Brit. Mus., p. 272 (Fiji Is.; Amboina; Sulu I.; Isle of Pines; India).

1885. *Platurus laticaudatus* var. *colubrina* Boettger, Offenbach. Ver. Naturk. 24-25 Ber., p. 155 (China Sea).

Description.—Halfgrown; U.S.N.M. No. 15236; China Seas; J. G. Swan, collector.—Rostral one-third higher than broad, scarcely visible from above; a pair of internasals narrowly in contact with rostral; three prefrontals, the median unpaired shield pentagonal, entirely separating the lateral ones, broadly in contact with the internasals in front and the frontal behind; frontal long, as long as parietals, much longer than its distance from tip of snout, wider than supraoculars; parietals short and broad, the two dimensions about equal; nostril large, behind the middle of a long and narrow undivided nasal which is broadly in contact behind with preocular and third supralabial; one high preocular; diameter of eye equaling its distance from edge of lip; two postoculars; 1 + 2 temporals, a small supernumerary shield being interpolated on the left side between anterior temporal and fifth and sixth supralabials; 7 supralabials, first somewhat broader above than below, sixth largest, third and fourth entering eye; mental very small and narrow; only anterior two lower labials reaching chin-shields, the posterior ones being very low, scarcely more than covering the labial edge; two pairs of chin-shields in contact throughout, posterior pair larger than anterior; 25 rows of smooth scales without apical pits; 230 ventrals, without median keel; anal divided; 32 pairs of subcaudals. Color (in alcohol) gray above, each scale pale at tip, yellow on sides and below, with 28 solid blackish brown rings around the body and 3 on tail, the rings being widest (about 5 scale rows) on middle of back, narrowest (about 1½ ventral) on belly, the pale interspaces above averaging about 4 scale rows in width, and 6 to 7 ventrals on underside; a broad yellow band from sides of neck across occiput, two scale rows behind parietals; head in front of this nearly to anterior edge of frontal blackish brown; snout, a superciliary line, entire upper lip and tip of lower lip yellow; a black band narrowly surrounding eye and extending over lower postocular and temporals; lower lip also blackish brown, the black of top of head, postocular band, and lower labial band united by a vertical black band behind angle of mouth.

Dimensions.

	mm.
Total length	692
Snout to vent	626
Vent to tip of tail	66

Adult specimens of this species are known having reached a length of nearly 1,300 mm.

Variation.—As in the other species of this genus the scale formula is very constant. A specimen (No. 149) from Queensland, in the Zoological Museum in Christiania, which I was allowed to examine through the kindness of Prof. Robert Collett, is remarkable for lacking the azygous shield between the prefrontals, thus resembling *L. laticaudata* in this respect, though otherwise a normal *L. colubrina*, as shown by its 23 scale rows and yellow supralabials.[a]

Habitat.—No specimen has been recorded from any definite locality within the limits of this work.[b] There are in collections, however, several specimens said to have been taken in the "China Seas," or "China Sea." As the latter is bounded by Formosa in the north, while on the other hand the range of this species mostly coincides with that of *L. laticaudata*, it seems quite probable that *L. colubrina* may be found in the seas about Formosa and the Riu Kius now that attention has been called to it.

As stated above, its general distribution is almost identical with that of *L. laticaudata* inasmuch as it is found from the Bay of Bengal to the western part of the South Pacific at least as far east as the Friendly Islands, extending southward to Australia and New Zealand.

List of specimens of Laticauda colubrina.

U.S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Subcaudals.	Dark rings on body.	Oculars.	Temporals.	Supralabials.
15236	Halfgr.[a]	China Seas		J. G. Swan	25	230	32	28	1.2	1—2+2	7

[a] Description, p. 407.

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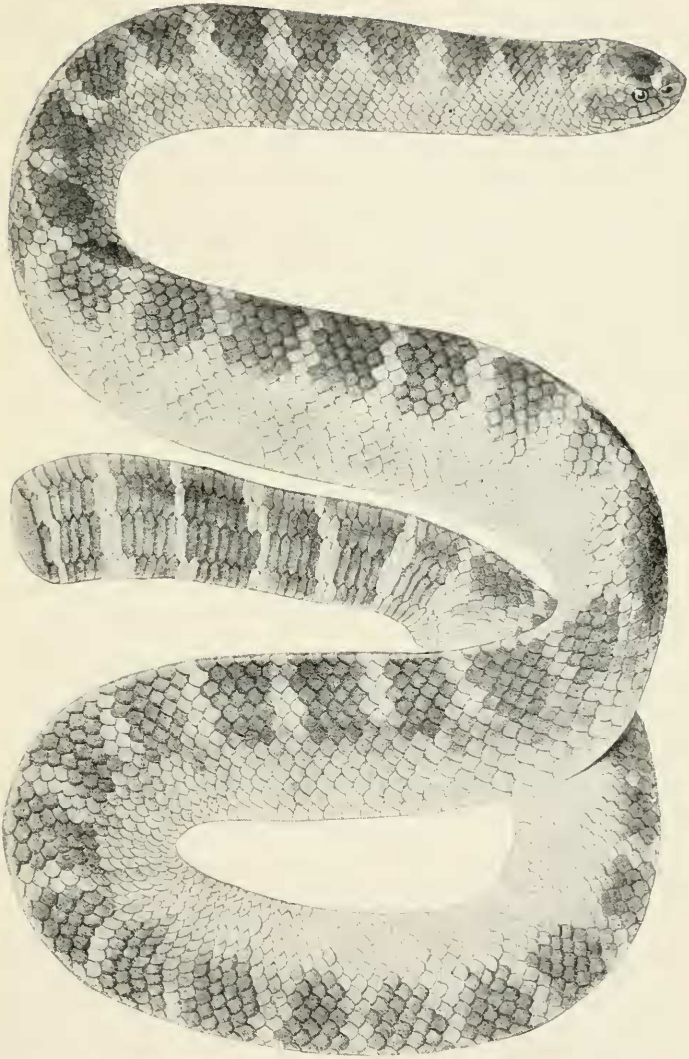
[a] Dr. Franz Werner (Mitt. Zool. Samml. Mus. Naturk. Berlin, I, Pt. 4, 1900, p. 104) mentions a similar specimen in the collection of the Vienna university, but he regards it as a hybrid between *L. laticaudata* and *L. colubrina*, a view I can not accept, at least for the specimen in the Christiania Museum, which is in every respect a typical *L. colubrina*, but lacking the unpaired prefrontal.

[b] Doctor Wall enumerates the species as No. 25 of his "List of Japanese and Loo Choo Islands Ophidia," but gives no reference to any record in substantiation.



LATICAUDA SEMIFASCIATA. (FROM TEMMINCK AND SCHLEGEL.)

FOR EXPLANATION OF PLATE SEE PAGE 555.

LATICAUDA SEMIFASCIATA[a] (Reinwardt).

ERABU-UNAGI.

Plate XXII.

1837. *Platurus semifasciatus* REINWARDT. in Schlegel, Phys. Serp., II, p. 516 (type-locality, Moluccas; type, Leiden Mus. No. 1468; Reinwardt, collector).

1837. *Hydrophis colubrina* SCHLEGEL, Phys. Serp., Atlas, pl. XVIII, figs. 18–20; Fauna Jap., Rept., 1837, p. 92 (Liukius); Ophid., pl. x[b] (probably Reinwardt's type).—*Platurus colubrinus* FISCHER, Jahrb. Wiss. Anst. Hamburg, V, 1888, p. 18 (Okinawa shima; Tonga; Society Is.).

1856. *Platurus fasciatus* var. *semifasciata* FISCHER, Abh. Naturw. Ver. Hamburg, III, p. 30, p. 70 (Reinwardt's type).

1860. *Platurus fasciatus* var. HALLOWELL, Proc. Phila. Acad., 1860, p. 489 (Loo Choo; Cleopatra I.).

1874. *Platurus schistorhynchus* GUENTHER, Proc. Zool. Soc. London, 1874, p. 297, pl. XLV, fig. B (type-locality, Savage Island; types in Brit. Mus.).—BOULENGER, Fauna Brit. India, Rept., 1890, p. 395 (China Seas); Cat. Sn. Brit. Mus., III, 1896, p. 309 (Savage I.; Loo Choo Is.).—WALL, Proc. Zool. Soc. London, 1903, p. 101 (Loo Choos); 1905, II, p. 517 (Miyako; Okinawa; Amami).

1876. *Platurus fasciatus* HILGENDORF, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, pp. 30, 31 (Prov. Satsuma) (not of Latreille).—DOEDERLEIN, Mitth. Deutsch. Ges. Ost-Asiens, III, heft 24, July 1881, p. 149 (Amami-o-shima); heft 25, Dec. 1881, p. 210 (Liukiu Is.: Erabu shima).—OKADA, Cat. Vert. Japan, 1890, p. 69. (Okinawa shima).

1876. *Platurus laticaudatus* PETERS, Mon. Ber. Berlin Akad. Wiss., 1876, p. 534 (Matuka, Fiji Is.) (not of Linnæus); 1877, p. 417 (part: Berlin Mus. No. 9663, Tonga; 9071, Samoa).

Reinwardt's *P. semifasciatus* must take precedence over Guenther's *P. schistorhynchus*. I have examined Reinwardt's type in the Leiden Rijksmuseum (No. 1468; probably the same individual which Schlegel has figured, Fauna Japonica, pl. x, especially fig. 2) from the "Moluques," and find it an unquestionable specimen of this species, with divided rostral, one pair of adjacent chin-shields, and keeled posterior ventrals.

Concurrent with the two apparently disconnected habitats of this species there seems to be an average difference in the number of ventrals. Thus in the eastern group (Tonga, Savage I.), in six recorded specimens the ventrals vary between 177 and 202 (average 187), while in eight western specimens (Riu Kius, Moluccas), they vary between 197 and 212 (average 205). Unfortunately there are two other specimens recorded which to some extent spoil this harmony, viz, one from the Riu Kius recorded by Boulenger[c] with only 188 ventrals, the other, from the Society Islands, recorded by Fischer,[d] with no less than 229 ventrals. With regard to the latter, I am strongly inclined to doubt either the accuracy of the count, the locality, or the identification, the number being so out of all proportion. I may finally remark that in the only Savage Island specimen examined by me (U.S.N.M. No. 28194) the number of light body rings is only 23. Guenther, in the original description of his Savage Island specimens, also gives 22 as the number of the body rings. In our Riu Kiu specimens the number of body rings varies between 35 and 43, and in the type of *L. semifasciata* the number is apparently about 38. No detailed record of the other specimens is accessible. It is consequently at the present moment impossible to decide whether we really have to do with two separable races, one with an average number of 205 ventrals and 38 body rings, typical *L. semifasciata*, from the Riu Kius and the Moluccas, and another form averaging 187 ventrals and 23 body rings, *L. semifasciata schistorhynchus*, from the Friendly Islands.

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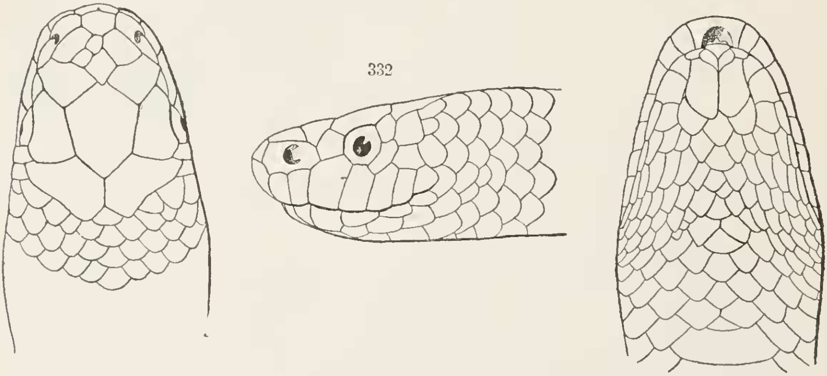
[a] From *semi-*, half; *fasciatus*, banded.

[b] Reproduced in this work on Plate XXII.

[c] Cat. Sn. Brit. Mus., III, p. 309: specimen *e*.

[d] Jahrb. Wiss. Anst. Hamburg, V, p. 19: Hamburg Mus. No. 384.



Figs. 331–333.—Laticauda semifasciata. 1⅓ × nat. size. 331, top of head; 332, side of head; 333, underside of head. No. 7515, U.S.N.M.

Description (figs. 331–333).—*Halfgrown;* U.S.N.M. No. 7336; Yoko shima (Cleopatra Island), Tokara group, Riu Kiu Archipelago; May, 1855; Captain Stevens, collector. Rostral broader than high, upper edge broad and truncate, scarcely visible from above; three internasals, one unpaired anterior adjoining the rostral, of which it is in reality only a detached portion, and two posterior normal ones broadly in contact; three prefrontals, a median pentagonal one, posteriorly broadly in contact with frontal, and two lateral ones, broadly in contact with frontal and with supraocular; frontal large, much longer than its distance from tip of snout and than the parietals, supraoculars as broad as frontal at the middle; parietals very short, not longer than broad, much shorter than frontal; nostril large, semilunar, near the middle of the long and narrow undivided nasal; no loreal; one preocular, broadly in contact with nasal; eye rather small, its vertical diameter less than its distance from edge of lip; two postoculars;

temporals 2+3, only slightly differentiated from the adjacent scales; seven supralabials, third and fourth largest and entering eye, first as wide above as below; seven lower labials, of which the first pair behind the small mental does not reach the edge of the lip, the labials from the third backward very low, only the first three in contact with chin-shields, of which only the anterior pair is clearly differentiated, the posterior being represented by two scales separated by one of nearly the same size; 23 rows of smooth scales without apical pits; 205 ventrals, on the posterior half of the body by a median blunt keel and a corresponding notch in the posterior edge of each scute; anal divided; 40 pairs of subcaudals. Color (in alcohol) bluish gray, darker above, paler underneath, with 43 dark brown rings around the body and seven on the tail, the bands being widest on the median line of the back, viz, about 3½ scales wide, and there separated by a pale interval only two scales wide; the rings are about 2½ ventrals wide on the underside and the light intervals about the same width; head uniform dark brown, with a yellowish horseshoe-shaped mark, the convexity of which rests on the prefrontals extending backward on the outer edge of supraoculars, upper postocular and upper temporals to and joining the first pale cross line on occiput a scale row behind the parietals; snout and labials dark brown like the rest of the head.

Dimensions.

	mm.
Total length	582
Snout to vent	507
Vent to tip of tail	75

The *young* (in alcohol) are of a light bluish gray with blackish brown rings and markings. The latter as the snake grows larger become lighter and the former darker and browner, while the demarcation between them becomes more obscure until in very large specimens the markings become almost obliterated. In the larger specimens therefore the dark gray cross markings correspond to the whitish cross markings in the young.

This species grows to a considerable size. The largest specimen in our collection (No. 5546) measures 1,097 mm. in total length, with a tail 136 mm. long, while the type measures, respectively, 1,118 mm. and 140 mm.

Variation.—There is very little variation in the scale formula proper, for only in one specimen (No. 5546) have I seen 4 temporals on one side, the normal number of 3 occurring on the other. In eastern specimens the number of ventrals is rarely as low as 188, but ranges usually between 197 and 212, while the subcaudals vary between 32 and 43 pairs. Sometimes anomalies are found in the internasals; thus in No. 10*b* of the Imperial Museum, Tokyo, there is a small unpaired shield behind the detached part of the rostral, broadly in contact with it and with the unpaired median prefrontal, and in our No. 7515 there are two unsymmetrical shields detached from the left internasal, as shown in fig. 331.

The variation in color and pattern has been referred to above (pp. 410 and 411).

Habitat.—Thus far this species has been recorded from only two disconnected areas very far apart, namely, from the Malay Archipelago (Amboina, according to Peters, and the type from the "Moluccas") and the Riu Kius in the west and from the Fiji, Samoa, and Tonga (Friendly) islands, the neighboring isolated Savage Island, and possibly the Society Islands in the east. No specimen from the intervening seas have been recorded, so far as I know.

In the Riu Kius this species appears to be common, as it can scarcely be doubted that this is the species of which Doederlein speaks as *Platurus fasciatus*, and which according to him is caught in considerable numbers at Erabu shima, in the northern group, so numerous in fact that the snake takes its name, Erabu-unagi, from that island, whence it is shipped to Japan to be used as a medicine. The Rogers Expedition brought home three specimens from Yoko shima (Cleopatra Island), which lies between the Tokara (Linschoten) group and Amami-o-shima, where Doederlein collected it. The Imperial Museum in Tokyo has specimens from Okinawa shima, where Doctor Warburg and Pryer's collector also obtained it. Doctor Wall mentions 29 specimens collected at Miyako shima. Finally, I have examined a specimen in the Hamburg Museum (No. 2633), collected by Doctor Lenz in Iriomote shima of the Yaeyama group.

List of specimens of Laticauda semifasciata.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received	Scale rows.	Ventrals.	Subcaudals.	Dark rings on body.	Oculars.	Temporals.	Supralabials.
U.S.N.M.	5546	Female	Cleopatra Isl	....	U. S. Expl. Exped. (?).	23	197	32	....	1,2	2+3 7	7
Do	7336	Halfgr.[a]	do	1855. May —	Capt. Stevens	23	205	40	43	1,2	2+3	7
Do	7380	Young	Loo Choo	....	W. Stimpson[b].	23	204	40	37	1,2	2+3	7
Do	7515	Female[b]	Cleopatra Isl	May —	Capt. Stevens	23	201	37	35	1,2	2+3	7
Imp. Mus. Tokyo.	10[a]	Halfgr.	Okinawa shima	....	....	23	212	43	37	1,2	2+3	7
Do	10[b]	do	do	....	....	23	208	41	35	1,2	2+3	7
Hamburg	....	(c)	Okinawa shima	....	Dr. O. Warburg.	23	210	41	....	....	....	....
Do	2633	Adult	Iriomote shima	1897. Mar. 13	Doctor Lentz.	23	....	....	....	....	....	....
Brit. Mus.	(d)	Female	Loo Choo Is	....	H. Pryer	....	188	36	....	....	....	....

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[a] Description p. 410.

[b] Probably "No. γ–198. *Hydrophis?* Taken off the south end of Loo Choo, December, 1854, by Captain Rodgers" of Stimpson's MS. Catalogue. In the Museum register the entry is only as above.

[c] Figs. 331-333.

[d] Fischer, 1888, p. 18.

Genus EMYDOCEPHALUS[a] Krefft.

1869. *Emydocephalus* KREFFT, Proc. Zool. Soc. London, 1869, p. 321 (type, *E. annulatus*).

Boulenger, with specimens of another species of this genus before him, still persists (Willey, Zool. Results, 1898, p. 57) in placing these snakes in the genus *Aipysurus* which he has diagnosed as having the "maxillary a little longer than the ectopterygoid [transpalatine];" "poison-fangs . . . followed, after a short interspace, by 6 to 10 grooved teeth."

In the genus *Emydocephalus*, on the contrary, the maxillary bone is shorter than the ectopterygoid, very much as in *Laticauda* (see Boulenger, Fauna Brit. India, Rept., p. 394, fig. 116A) *even slightly more reduced*. Behind the fang there is no trace of another tooth, such as is found in *Laticauda*, not even an impression on the surface of the bone. Add to this the remarkable and apparently constant fusion of the median labials, which some authors might regard as a good generic character in itself, and the status of *Emydocephalus* seems assured. So far as I can see, it is more closely allied to *Laticauda* than to *Aipysurus*, the chief difference being the presence of internasals and the consequent more lateral position of the nostrils.

The genus, which is as yet but very poorly known, seems to contain three species, the one here described, from the Riu Kiu and Formosan waters; *E. chelonicephalus*, from the Loyalty Islands; and *E. annulatus*, with single anal, and strongly tuberculated scales, from a locality, probably somewhere in Australian waters.

In discussing the specific characters of the species constituting the genus *Aipysurus*, Doctor Guenther[b] speaks of the head shields being much subdivided in old examples, implying that they are not so much subdivided in the young. While our present species is not strictly congeneric with those treated of by Doctor Guenther, it seems nearly enough related to make it proper to question the above inference. I have before me an adult female with two embryos ready to be expelled, and in all three the scutellation of the head is so identical that the conclusion seems justified, that no change takes place as the snake grows older, and that where a difference occurs it is due either to individual or to specific variation.

EMYDOCEPHALUS IJIMÆ[c] Stejneger.

1898. *Emydocephalus ijimæ* STEJNEGER, Journ. Sci. Coll. Tokyo, XIII, Pt. 3, p. 223 (type-locality, Riu Kiu Sea; type, U.S.N.M. No. 36517; Tashiro, collector).

1899. *Aipysurus annulatus* BOULENGER, Zool. Record for 1898, Rept. Batr., p. 21 (not of Krefft).—WALL, Proc. Zool. Soc. London, 1903, pp. 95, 101; 1905, II, p. 517 (Okinawa).

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[a] From ἐμύς, turtle; κεφαλή, head.

[b] Rept. Brit. India, p. 357.

[c] Named in honor of Prof. Isao Ijima, Science College, Imperial University, Tokyo.

It has been intimated by Boulenger (Zool. Rec. for 1898, Rept. Batr., p. 21) that this species is identical with Krefft's *E. annulatus* (of unknown habitat) and Bavay's *E. chelonicephalus*, from the Loyalty Islands. I shall express no opinion here as to whether he is right in thinking it "advisable to consider, provisionally, at least," the latter which has a rostral bearing a conical, spine-like tubercle to be the same species as Krefft's snake,[a] but I must dissent most emphatically from having *E. ijimæ* included with any of them. Its four prefrontals, divided anal, enlarged posterior vertebrals and smooth scales seem at once to forbid such a procedure, notwithstanding the fact that all the specimens of this genus show a remarkably small range in the number of their ventrals. That we have not to do with individual or sexual variations is proven by the fact that I have seven specimens, mature ones of both sexes as well as young ready to be born, which agree in all essential points. They all possess the enlarged vertebrals and four prefrontals, thus making out a pretty conclusive case for the distinctness of this species. Doctor Wall, who examined three of the specimens now in the National Museum, remarks that "an examination of the specimens [of *E. chelonicephalus*?] in British Museum shows that a certain slight enlargement of the vertebrals is present at some spots, but no specimen has four prefrontals." It should be mentioned, however, that in a specimen recently received by British Museum from Mr. Owston (No. 1903.6.29.23) as collected in the Yaeyama Islands, the two outer prefrontals are fused with the inner ones, and that Doctor Wall has since recorded another with similarly fused prefrontals.

Description.—Adult female; Science College Museum, Tokyo, No. 1; Riu Kiu Seas; 1888; Tashiro, collector (figs. 334–337). Head short; body rather short and stout; rostral broader than high, pentagonal, the labial border with a posterior projection which fits into the mental groove; nasals as long as frontal, twice as long as suture between prefrontal, and wider than long, in contact on median line and with very large semilunar nostrils situated on top near posterior border, the concavity directed forward; two pairs of prefrontals, the median pair large, pentagonal, in contact with nasals, frontals, supraocular and outer prefrontals which are small and nearly square and in contact with median prefrontals, nasals, preocular, and supraocular; frontal rather small, hexagonal, about as broad as long; supraoculars similar, but slightly longer; parietals rather large, about as broad as long; one preocular, pentagonal; two postoculars, the upper largest, followed by two similar, but slightly larger, temporals; three supralabials, only the first and last being of normal size, the second forming a large plate corresponding to at least four ordinary supralabials, and bordering the eye below; mental deeply notched in front and divided by a deep median groove, followed behind by a pair of narrow shields which do not reach the commissure; behind these a pair of large chin-shields in contact, followed by another pair separated by an unpaired shield slightly smaller; three lower labials, on right side, four on left, first and third (and fourth) quite small, second forming a large plate corresponding to the second supralabial; dorsal

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[a] One of our specimens of *E. ijimæ*, U.S.N.M. No. 33942, has also a very pointed conical tubercle on the rostral as well as numerous other pointed asperities or tubercles on the anterior facial shields. Another (No. 33943) has tubercles on other head shields, though the one on the rostral is not so prominent and pointed as in the other. Both of these specimens are males. The third is a female with entirely smooth shields. This character then seems to be sexual and not specific.

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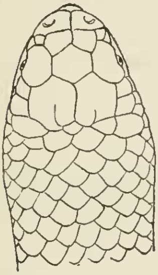

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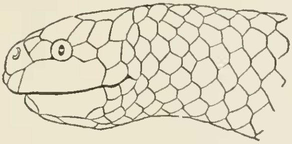

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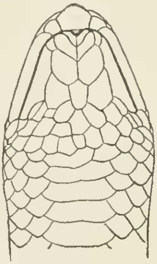

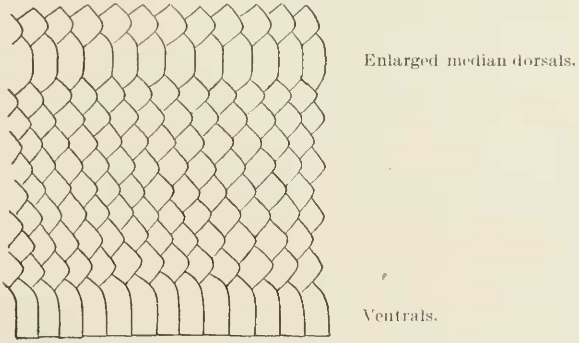

FIGS. 334-337.—EMYDOCEPHALUS IJIMÆ. NAT. SIZE. 334, TOP OF HEAD; 335, SIDE OF HEAD; 336, UNDERSIDE OF HEAD; 337, SCUTELLATION AT MIDDLE OF BODY. No. 1, SCI. COLL. TOKYO.

scales large, strongly imbricate, 15 rows around neck, 17 around middle of body, subequal, except median row which on the posterior four-fifths of the body and tail is greatly enlarged, twice as wide as the others, hexagonal and gastrostege-like; the scales are smooth, but under the magnifying glass show a few slight tubercle-like elevations; ventrals 140, wide with a rounded median keel in the posterior half; anal large, regular, divided; subcaudals, 23, undivided; basal half of tail with four scale rows on each side between the marginals above and below, the terminal half with three such rows; a large terminal rounded shield, irregularly frayed along the edges. Color (in alcohol) of a rich dark chestnut with narrow, bright ochraceous yellow cross-bands round the entire body, one to two scales wide on the back and two to three scales on the sides, and about four scales distant; a similar yellow band from angle of mouth through anterior temporals, upper postocular, outer half of supraocular to median prefrontals; a few irregular yellowish marks on second supralabial and on throat.

Dimensions.

	mm.
Total length	890
Snout to vent	778
Vent to tip of tail	112

Variation.—A *young* specimen (U.S.N.M. No. 36517), ready to be born and taken from the abdomen of the above described specimen, is a perfect counterfeit of the old snake differing only in the following particulars: (1) It has 17 scale rows around the neck as well as around the middle of the body; (2) the mental is large, nearly heart-shaped, with a deep median groove, and the pair of narrow shields between the mental and the first pair of chin-shields is wanting. In other respects, notably the size and shape of the head-shields, the remarkable consolidation of the labials in both jaws, in the great width of the median dorsal scale row as well as in color, the two specimens agree completely. Enough of another young, still attached to the mother was freed from the egg membranes to ascertain that these points are equally developed in this specimen.

A fourth specimen is the *male* from Botel Tobago, mentioned by me when first describing the species. Although about a third smaller than the mature female described above, it appears to be adult, and agrees in almost every particular with that specimen. The only point of difference is that the rostral has a slightly elevated point, somewhat indicative of the spine in *E. chelonicephalus.* This character seems to be confined to the male sex. The specimen in question has 17 scale rows; 142 ventrals; a double anal; and 28 undivided subcaudals. Total length 613 mm.; tail, 93 mm. The fact that this specimen, as well as the three others in the National Museum, agrees with the adult female in having a pair of narrow shields immediately behind the small grooved mental and before the first pair of regular chin-shields, proves that the condition in the young specimens in which these pseudo-chin-shields are fused with the mental is an individual aberration only.

These "postmentals" or "pseudo-chin-shields," however, seem to be the first pair of sublabials which have been crowded away from the lip. The posterior lower projection of the rostral fits snugly into the anterior notch and groove of the mental and closes the mouth effectively.

The number of scale rows varies between 17 and 19, though the former seems to be the normal number; ventrals between 134 and 143, subcaudals between 23 and 28.

A specimen in British Museum, as previously mentioned (p. 414), has the outer prefrontals fused with the inner ones.

Since the above was written Doctor Wall has reported upon six examples obtained by Mr. Owston's collectors in Okinawa. Four had a sharp spine on the rostral, which was absent on the other two. The prefrontals were very irregular. There were four in three specimens, two in one specimen, and three (2 right, 1 left) in two specimens. In all one or both parietals were split by a suture behind. The scales were 17 in mid-body when the vertebral row was enlarged, which was usually the case, though often to a variable degree. In two specimens the scales were 19, the vertebrals being divided into three rows subequal to the other dorsals. Ventrals numbered 138 to 143.

Habitat.—This species is only known from the "Riu Kiu Sea," where Tashiro collected the gravid female in 1888, and from Botel Tobago Island, east of the south end of Formosa. A specimen was caught there on the rocks at ebb tide by Mr. Tsunasuke Tada, May 1897. Three specimens obtained by Mr. A. Owston's collector, on Ishigaki Island of the Yaeyama group, during the month of May, 1899, are now in the United States National Museum, and two are in British Museum, one from Yaeyama Island and one from Iriomote. Doctor Wall now records six specimens from Okinawa.

List of specimens of Emydocephalus ijimæ.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.
U. S. N. M..	33942	Male....	Yaeyama Islands...	1899. Apr.-May	A. Owston...	19	139	2	28
Do.....	33943	...do....	.....do...............	.....do....	.....do.......	19	138	2	28
Do.....	33944	Female .	.....do...............	.....do....	.....do.......	17	140	2	24
Do.....	36517	Young[a]	Riu Kiu Seas........	1888.	Tashiro......	17	138	2	23
Sci. Coll. Tokyo.	1	Female[b]	.....do...............	1888.	1888.	17	139	2	23
Do.....	1a	Male....	Botel Tobago Island.	1897. May	T. Tada.....	17	142	2	28
Brit. Mus..	1901. 10. 23. 8	....do...	Iriomote shima......	....	Doctor Wall.	19	136	2	27
Do.....	1903. 6. 29. 23	Female .	Yaeyama Island.....	....	A. Owston...	19	134	2	....

[a] Type, p. 416.

[b] Description, p. 414; figs. 334-337.

Genus DISTEIRA[a] Lacépède.

1803. *Hydrophis* DAUDIN, Hist. Nat. Rept., VII, p. 372 (part; not of Latreille, 1802).

1804. *Disteira* LACÉPÈDE, Ann. Mus. d'Hist. Nat., Paris, IV, p. 210 (type, *D. doliata*).

1804. *Leiosclasma* LACÉPÈDE, Ann. Mus. d'Hist. Nat., Paris, IV, p. 210 (type, *L. striata*).

1830. *Enhydris* WAGLER, Nat. Syst. Amph., p. 166 (type, *Hydrophis cyanocinctus*) (not of Latreille, 1802).

1834. *Microcephalophis* LESSON, in Bélanger's Voy. Indes Orient., Rept. (p. 320); Atlas, Rept., pl. III (type, *M. gracilis*).

1842. *Liopala* GRAY, Zool. Misc., p. 60 (type, *Hydrus gracilis* Shaw).

1842. *Liopola* GRAY, Zool. Misc., p. 60 (err. typogr.).

1842. *Aturia* GRAY, Zool. Misc., p. 61 (type, *A. ornata*).

1848. *Noterophis* GISTEL, Naturg. Thierr., p. IX (substitute for *Enhydris* Wagler).

1849. *Chitulia* GRAY, Cat. Sn. Brit. Mus., p. 56 (type, *Ch. inornata*).

1849. *Kerilia* GRAY, Cat. Sn. Brit. Mus., p. 57 (type, *K. jerdonii*).

1852. *Thalassophis* SCHMIDT, Abh. Naturw. Ver. Hamburg, II, Pt. 2, p. 75 (substitute for *Hydrophis* Daudin).

1887. *Distira* COPE, Bull. U. S. Nat. Mus. No. 32, p. 61 (emendation).

The large central group of Hydrid snakes, about 40 species, has been gathered into two genera by Boulenger according to whether the maxillary teeth following the first pair of poison fangs are grooved (*Disteira*) or "solid" (*Microcephalophis* = *Hydrophis* Daudin, 1803, not Latreille, 1802). Recently some doubt has been thrown on the validity of this separation, inasmuch as Mr. West, in a typical *Disteira*, viz, *D. cyanocincta*, found that "the first two or three only of these teeth showed any indications of a groove."[b]

Relying, however, on the division established by Boulenger, I identified some of my specimens in which no grooved teeth were observable under a magnification of 10 diameters, as *Microcephalophis melanocephalus*.[c] Three years later some similar snakes came under my notice, which, investigated by the same means, showed distinct grooves in the maxillary teeth, and as their other characters did not correspond to those of any other *Disteira*, I described them as a new species, *D. orientalis*.[d] While preparing detailed descriptions for the present work, however, I was forcibly struck by the fact that in all external characters the two species were absolutely identical. Mr. West's experience with *D. cyanocincta* and other parallel cases with various opisthoglyph snakes then occurred to me. The specimens at my command were consequently subjected to much greater magnifications, with the result that I find all the teeth grooved in all the specimens examined by me. To see the groove plainly it was often necessary to use a binocular microscope magnifying 45 diameters, and to make sure of the presence of grooves on the anterior face of the maxillary teeth of *Disteira gracilis* it was even necessary to raise the power to 65 diameters. From my experience it is then plain that there is no real difference between the "grooved" and the "solid" maxillary teeth in these snakes, that it is merely a question of degree.

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[a] From δις, double; στεὶρα, keel.

[b] Proc. Zool. Soc. London, 1895, p. 823, pl. XLVI, fig. 8.

[c] Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 224.

[d] Proc. Biol. Soc. Washington, XIV, 1901, p. 191.

Under these circumstances there seems to be no other course than to unite the two supposed genera (and species!), the name *Disteira* being available for the thus consolidated genus. The term *Hydrophis* must disappear from our nomenclature, as Latreille, in 1802, framed it as a substitute pure and simple for *Hydrus*, while Daudin, in 1803, substituting *Pelamis* for the latter reemployed the former for the bulk of the Hydrid snakes.

Within the enlarged genus the limits and characters of the species offer some of the most difficult problems to the ophiologist. These snakes, in many respects so excessively specialized, often show a correspondingly excessive amount of individual variation, and as the series available for study is insignificant except in the case of a few species the result must of course be in great doubt.

If, for instance, we take the latest monographic account of these snakes, namely, Boulenger's treatment of them in the Catalogue of the Snakes in British Museum, by far the ablest treatise on the genus, based upon the largest material in any collection, we find that of 22 species recognized by him in the genus *Hydrophis* he had 77 specimens, or an average of 3.5 specimens to each species.[a] If we analyze this material for the variability of the number of ventrals we come to the result that the range of the ventrals, that is, the difference between the greatest and smallest number of ventrals—of the specimens of each species in British Museum is greater in proportion as the series of specimens examined increases. This is startlingly shown in the following table:

Number of specimens in British Museum.	Range of ventrals.	Name of species.	Number of specimens in British Museum.	Range of ventrals.	Name of species.
13	147	*fasciatus.*	4	40	*nigrocinctus.*
12	128	*obscurus.*			*coronatus.*
10	74	*gracilis.*	3	35	*elegans.*
8	24	*cærulescens.*	2	36.5	*mamillaris.*
5	42.5	*spiralis.*			*cantoris.*
		torquatus.			

The only exception is the series of eight *H. cærulescens* in which the range of variability of the ventrals is unusually low. These specimens however, cover a relatively small geographic range.

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[a] In no instance did he have more than five specimens from one locality.

The 27 specimens of *D. melanocephala* examined by me are practically from the same locality, and so is the Miyakoshima specimen recorded by Boettger. Even the type of the species collected by Sir. E. Belcher may well have been picked up at the same island. In these 29 specimens the range of the ventrals only amounts to 56, while in the 13 specimens enumerated by Boulenger as *H. fasciatus* it amounts to 147. His 13 specimens, however, cover a range from Malabar to China. If we eliminate the two types of Guenther's *Hydrophis atriceps*, with 364 and 353 ventrals, respectively, which I am inclined to refer to *D. melanocephala*, the variation in the ventrals is reduced to only 98.

The rational explanation seems to be that the individual variation in a fairly large series from *the same locality* is within reasonable bounds, and that the so-called "species" must be broken up on different lines from those which have been established by Boulenger.

This question is particularly important to us in the present connection, as some of the species which are reported from the waters adjacent to the region here treated of are very closely related, their differences consisting mostly in slight gaps between their scale formulas. The three species alluded to agree in having a very small head and a long body very slender anteriorly. As a rule they have a single large anterior temporal, and two pairs of small chin-shields in contact.

Carefully noting what is said in the following under the discussion of each species the various forms treated of may be distinguished by the following:

KEY TO THE SPECIES OF DISTEIRA IN CHINESE[a] AND JAPANESE WATERS.

a^1 Frontal shield longer than broad.
  b^1 Ventrals more than 295.
    c^1 A single anterior temporal (normally).
      d^1 Scale rows around the neck more than 23 (25–33).
        e^1 Scale rows around body 38, or less (38–32); ventrals less than 371 (301–370). *D. melanocephala*, p. 421.
        e^2 Scale rows around body 40, or more (40–56); ventrals more than 399 (400–500)........[*D. fasciata*] p. 427.
      d^2 Scale rows around neck less than 23 (19–21)........[*D. gracilis*] p. 427.
    c^2 Two anterior temporals........*D. cyanocincta*, p. 428.
  b^2 Ventrals less than 295........*D. godeffroyi*, p. 430.
a^2 Frontal shield as broad as long........[*D. viperina*] p. 434.

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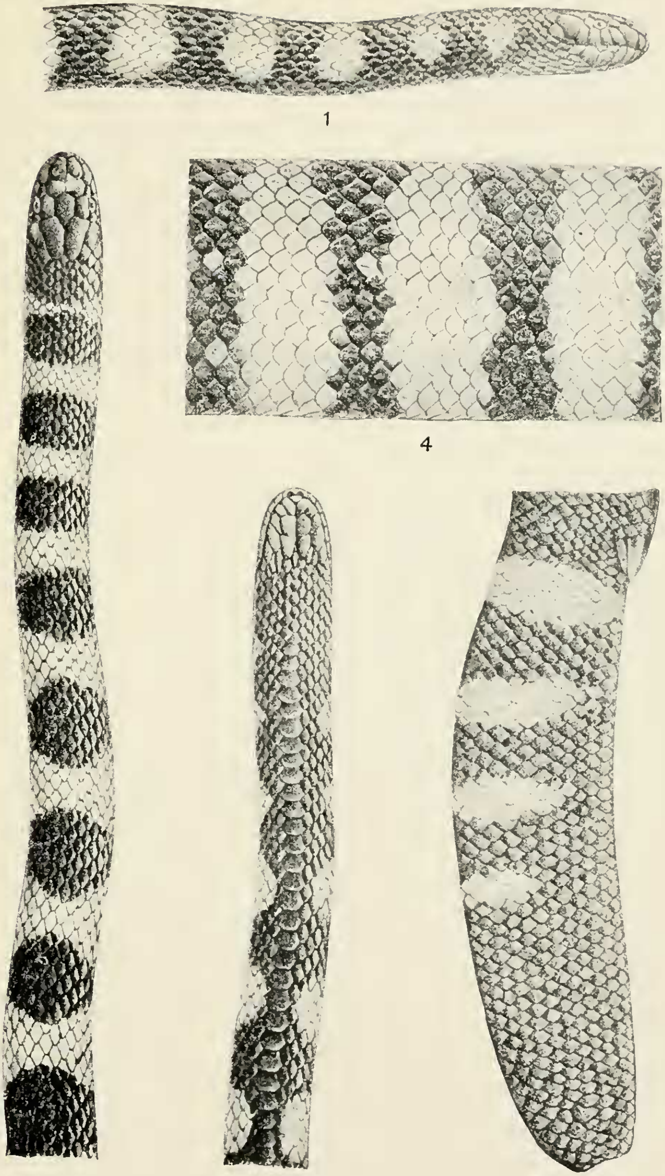
[a] The six snakes mentioned by Peters (Mon. Ber. Berlin Akad. Wiss., 1872, p. 859) under the name of *Hydrophis diadema* Guenther, from the coast of China and Siam (Berlin Mus. Nos. 4428, 7428 and 4747) can scarcely belong to that species, if it is identical with *D. obscura*, for which Boulenger gives the following scale formula: Scales around neck, 33–40; around body, 40–50; ventrals, 310–438. Peters's specimens have 31–33 neck scales, 37–40 body scales, and the one specimen of which the ventrals were given has 296. This scale formula does not agree with any of the species as diagnosed by Boulenger.



DISTEIRA MELANOCEPHALA. (FROM BOULENGER.)

FOR EXPLANATION OF PLATE SEE PAGE 555.

DISTEIRA MELANOCEPHALA[a] (Gray).

Plate XXIII.

1849. *Hydrophis sublævis*, var. *melanocephala* Gray, Cat. Sn. Brit. Mus., p. 53 (part: type-locality, "Indian Ocean;" type in Brit. Mus.; Sir E. Belcher, collector).
1864 ?*Hydrophis atriceps* Guenther, Rept. Brit. India, p. 371, pl. xxv, figs. *I*–*I*^{1} (type-locality, Siam; types in Brit. Mus.).
1895. *Hydrophis fasciatus* Boettger, Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 111 (Miyákoshima, Riu Kiu); Kat. Schl. Mus. Senckenberg., 1898, p. 113 (Miyakoshima) (not of Schneider).
1896. *Hydrophis melanocephalus* Boulenger, Cat. Sn. Brit. Mus., III, p. 283, pl. xv [b] (Indian Ocean; type).—Wall, Proc. Zool. Soc. London, 1903, pp. 95, 101 ("Loo Choos"); 1905, II, p. 516 (Ishigaki; Iriomote).—*Microcephalophis melanocephalus* Stejneger, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 224 (Pescadores Ils.).
1901. *Disteira orientalis* Stejneger, Proc. Biol. Soc. Washington, XIV, Dec. 12, 1901, p. 191 (type-locality, Okinawa shima; type No. 29, Imper. Mus., Tokyo).
1903. *Distira subcincta* Wall, Proc. Zool. Soc. London, 1903, p. 95 (part: "Japan, Loo Choos;" not of Gray).

The line drawn between this and the following species, *D. fasciata*, viz, at the 370–399th scale rows, is possibly an arbitrary one, but I am inclined to believe that in this way we obtain better results and come nearer the truth. It is not certain, however, that other characters coincide with such a division, and possibly it might be better to separate the two forms according to the scale rows around the body, but the records are very defective on this point. On the other hand, there may even be three forms, one more or less confined to the coasts of India and the Bay of Bengal, with the maximum average of ventrals and body scales; another intermediate form from the Malay island world and adjacent coasts of the mainland, and a third, with a more eastern habitat, including the China Seas, having the minimum number of ventrals and scales.[c]

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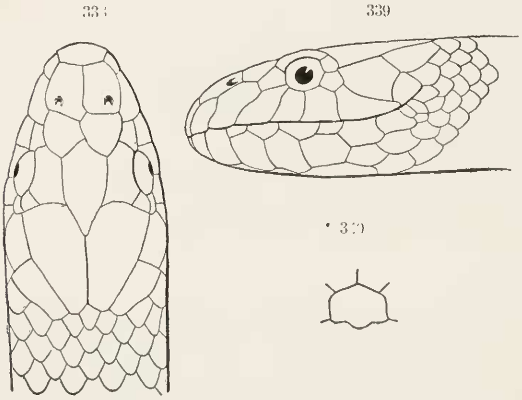
[a] From μέλας, black; κεφαλή, head.

[b] Reproduced in this work on Plate XXIII.

[c] There is a very serious obstacle to the defining of these forms from the records, viz, the difficulty in counting the scales and scutes of these snakes exactly. In the records we find the most divergent figures for the same specimens. Thus among the snakes included by Boulenger in this species, British Museum Nos. *a*, *d*, and *e* seem to be three of the four specimens mentioned by Guenther (Rept. Brit. India, p. 371) as *H. lindsayi*. These four he gives as having, respectively, 345, 390, 424, and 449 ventrals, while Boulenger's count is 402, 412, and 452. Guenther states that the number of ventrals of the type of his *H. atriceps* is 376; Boulenger counts 364. Guenther describes Gray's *H. ocellata* as having 296–334 ventrals, mentioning three specimens, one of these the type; according to Boulenger (p. 291), these three specimens (including the type) have 274, 275, and 290 ventrals; Guenther examined four *H. ornata*, among which the type and that of *H. inornata* and gives the ventrals of the species as 252–260; according to Boulenger the ventrals of the two types mentioned are 232 and 240.

The case would perhaps be less complicated if we knew all the data relating to the types of Guenther's *H. atriceps*. They seem to have a sufficiently low number of ventrals to be included within *D. melanocephala*, but I can find no details relating to the number of scales round the body. Guenther gives the number of scales around the neck as 26 and 28, respectively, consequently well within the limits of *D. melanocephala*, and I have consequently referred them, provisionally at least, to the latter rather than to *D. fasciata*.

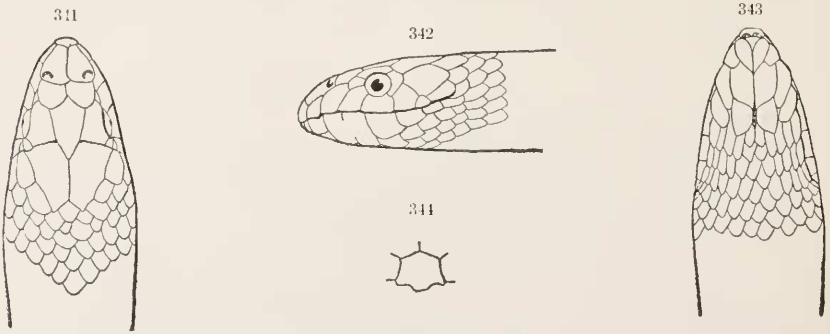


Figs. 338-340.—Disteira melanocephala. 2 × nat. size. 338, top of head; 339, side of head; 340, rostral. No. 4, Sci. Coll. Tokyo.

Boettger's *H. fasciatus*, from "Miyakoshima," with 27 scales round the neck, 38 round the body, and 355 ventrals, is clearly identical with the twenty-one specimens from the same locality now before me.

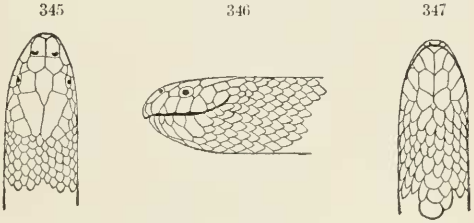
With regard to my *Disteira orientalis*, which was based upon specimens with posterior maxillary teeth plainly showing grooves under a low magnification, and consequently believed then to belong to a different genus, see remarks above under the genus (p. 418).

Description (figs. 338–347).—*Adult female:* U.S.N.M. No. 33945; Ishigaki shima, Yaeyama group, Riu Kiu archipelago; April-May, 1899; A. Owston collection. Rostral much wider than high, well visible from above; nasals very long, the suture between them twice as long as that between the prefrontals; the semicircular valvular nostril situated near the outer posterior corner of the nasal; frontal hexag-



Figs. 341–344. Disteira melanocephala. 2 × nat. size. 341, top of head; 342, side of head; 343, underside of head. 2⅔ × nat. size. 344, rostral. No. A40, High School, Kumamoto

onal, slightly longer than its distance from rostral, shorter than parietals, half as wide as long, wider than supraoculars; parietals as long as frontal and prefrontals together; no loreal; one preocular; one postocular; one large anterior temporal; 7 supralabials, second in contact with prefrontal, third and fourth entering eye, sixth very small; 3 lower labials in contact with anterior chin-shields; posterior chin-shields nearly as large as anterior, separated by a small scale; 25 rows of smooth, imbricate scales round the neck, 35 rows round the middle of the body, the scales on the body being imbricate and provided with a short keel which reaches neither base nor tip of scale; about 340 ventrals which often are so reduced as to be distinguished with difficulty from the scales, each ventral with two incomplete keels; anal divided, with an elongated smaller shield on each side; 40 subcaudals; terminal scale of tail small, only differentiated on one side. Color (in alcohol) above cinereous, white below, with 50 blackish rings round the body and 5 on the tail; head black with superciliary region and snout irregularly pale, the posterior supralabials being likewise light colored with a brownish tinge.



Figs. 345-347.—Disteira melanocephala. nat. size. 345, top of head; 346, side of head; 347, underside of head. No. 14, Imper. Mus. Tokyo.

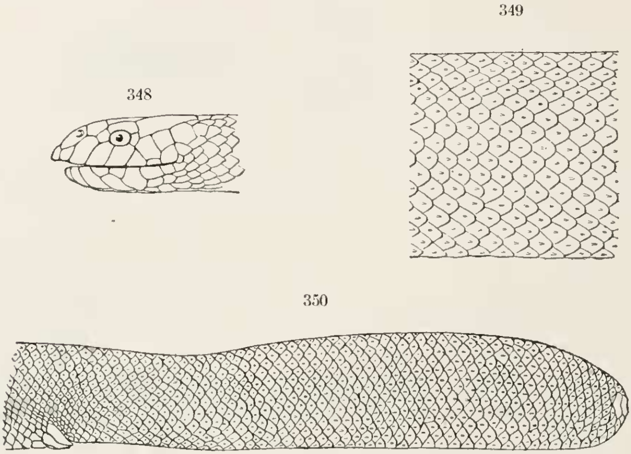
Dimensions.

Head very small; neck and anterior part of body very slender, increasing in thickness backward, the greatest height of the body being nearly 4 times the diameter of the neck.

	mm.
Total length	1, 125
Snout to vent	1, 027
Vent to tip of tail	98
Width of head	15
Diameter of neck	11
Greatest height of body	42
Greatest height of tail	26

The *male* is relatively much slenderer posteriorly.

Adult male; Imperial Museum, Ueno Park, Tokyo, No. 29; Okinawa shima, Riu Kiu Archipelago (figs. 348–350). Rostral nearly as high as broad, somewhat projecting, the portion visible from above longer than interprefrontal suture; nasals long, the suture between them twice as long as the one between the prefrontals, nostrils semilunar close to the outer posterior angle; frontal long and narrow, the length equaling distance from tip of snout and length of parietals, the width at the middle equaling that of the supraoculars; parietals long, the suture between them slightly longer than internasal suture; no loreal; one preocular; one postocular; one anterior temporal; 7 supralabials, sixth smallest, second largest, broadly in contact with prefrontal third and fourth entering eye; 3 lower labials in contact with anterior chin-shields which are somewhat shorter than the posterior, the latter broadly in contact anteriorly; 25 rows of smooth scales on the neck, 33 shortly keeled or tuberculated ones on the middle of body; 323 bicarinate ventrals, often scarcely differentiated; 4 subequal, elongate anals in a line· 43 subcaudals; terminal scales of tail but slightly differentiated. Color (in alcohol) very pale yellow, more ochraceous on back, with 50 blackish rings on back, six on tail, wider on the back and belly and confluent on the anterior third of the latter into a black ventral band, the dark rings narrower than the pale interspaces; head blackish with an irregular yellow spot on most of the shields, except posterior supralabials; lower labials, chin, and throat blackish; tip of tail black.



FIGS. 348-350.—DISTEIRA MELANOCEPHALA. NAT. SIZE. 348, SIDE OF HEAD; 349, SCUTELLATION AT MIDDLE OF BODY ($\frac{3}{4}$ × NAT. SIZE); 350, SIDE OF TAIL. NO. 29, IMPER. MUS. TOKYO.

Dimensions.

Head small; neck and body slender, especially anteriorly.	*mm.*
Total length	1,080
Snout to vent	985
Vent to tip of tail	95
Width of head	8
Diameter of neck	7
Greatest height of body	27
Greatest height of tail	21

The *young* resemble the adults except that the black color is more extended, so that the coloration of the snake may be described as black with narrow whitish rings which are mostly interrupted on the underside, the whole lower neck and a more or less complete longitudinal band on the ventrals being black; head entirely black with a whitish postocular band and a pale spot on each of the prefrontals; tail black with a few lateral, vertical, white bars or spots.

Variation.—The extreme specialization of these snakes is accompanied by a correspondingly great variability. Thus the reduced ventrals are so irregular and so often subdivided to the size of the adjacent scales that their number in a large series shows an excessive range, a feature alluded to above under the preliminary discussion of the species (p. 420). The head shields also show considerable variation, though to a less degree. The supralabials are 7, as a rule, but 8 are occasionally found, and 6 very seldom; three of them may enter the eye; two postoculars occur, but one is the normal number; posterior chin-shields in contact as a rule, but occasionally separated by a scale. The most notable variation, however, is the occasional, though rare, presence of two anterior temporals, because the scale formula of such specimens reads like that of *D. cyanocincta*, in which two anterior temporals is the rule. The arrangement, however, is different, for while in the former the two anterior temporals are produced by the horizontal division of the larger temporal located above the very small sixth supralabial, in the latter it is caused by the horizontal division of the fifth supralabial. In the former case we have the very small sixth supralabial between the much larger fifth and seventh, while in the latter the three are subequal or the sixth intermediate in size between the other two.

In the Pescadores Island specimens the small sixth supralabial on the left side is abnormally fused with the fifth, as shown in fig. 339; but on the other side it is normal.

Habitat.—The locality whence came the type of this species is given as "Indian Ocean," but as it is one of specimens brought home by Sir E. Belcher, this probably means only that it was obtained during his cruises in the "Samarang" in which case it is just as likely to have been collected in the China Sea or even in the waters about the Riu Kius, where it is evidently a common snake, as I have examined 24 specimens from the southern group (Saki shima), one from Okinawa, and one from the Pescadores in the Formosa Channel. Here also belongs the *H. fasciatus* recorded by Boettger from "Miyakoshima." Finally there is the specimen in the Rijksmuseum in Leiden (No. 1483). It is labeled "*Hydrophis striatus*, von Siebold, Japan." However, it is not the specimen figured under that name in Fauna Japonica (Ophid., pl. VII), but most probably the specimen referred to in the text (p. 89) as "harponné près des îles Lioukiou au 27me degré de lat. bor." apparently the only specimen collected by von Siebold.[a] It would therefore almost appear as if this species were confined to the neighborhood of the Riu Kiu Islands.

List of specimens of Disteira melanocephala.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows on neck.	Scale rows on body.	Ventrals.	Subcaudals.	Supralabials.	Anterior temporals.
U.S.N.M......	33945	Female[a]	Ishigaki shima, Riuku.	1899. Apr.-May.	A. Owston....	25	35	340	40	7	1
Do.......	33946	Male....	.....do..........	.....do....	.....do........	27	35	323	35	7	1
Do.......	33947	...do....	.....do..........	.....do....	.....do........	25	35	318	48	7	1
Do.......	33948	Female.	.....do..........	.....do....	.....do........	27	37	328	42	7	1
Do.......	33949	Male....	.....do..........	.....do....	.....do........	27	33	314	42	7	1
Do.......	33950	...do....	.....do..........	.....do....	.....do........	25	35	315	44	7–8	1
Do.......	33951	Female.	.....do..........	.....do....	.....do........	31	35	322	43	7–8	1
Do.......	33952	...do....	.....do..........	.....do....	.....do........	29	35	345	40	7	1
Do.......	33953	Male....	.....do..........	.....do....	.....do........	27	35	313	40	7	1
Do.......	33954	Female.	.....do..........	.....do....	.....do........	29	35	345	39	7	1
Do.......	33955	Young..	.....do..........	.....do....	.....do........	25	33	336	43	7–8	1
Do.......	33956	...do....	.....do..........	.....do....	.....do........	27	33	331	44	7–8	2
Do.......	33957	...do....	.....do..........	.....do....	.....do........	25	35	327	42	7	1
Do.......	33958	...do....	.....do..........	.....do....	.....do........	25	35	339	44	7–8	1
Do.......	33959	Male....	.....do..........	.....do....	.....do........	25	35	357	45	8	1
Do.......	33960	Female.	.....do..........	.....do....	.....do........	27	35	311	35	7	1
Do.......	33961	Male....	.....do..........	.....do....	.....do........	25	35	317	47	7	1
Do.......	33962	Female.	.....do..........	.....do....	.....do........	27	33	356	37	6–7	1
Do.......	33963	Male....	.....do..........	.....do....	.....do........	27	35	353	49	8	1
Kumamoto..	A 40	Young[b]	.....do..	1891	....	27	33	324	42	7	1
Senckenberg..	......	([c])	Miyakoshima ..	....	B. Schmacker	27	38	355	53	7	1
Brit. Mus....	*a*	Female[d]	"Indian Ocean"	1897	Sir E. Belcher.	25	35	329	....	....	1
Do.......	*b*	...do.[e]..	Iriomote shima.	....	Doctor Wall..	25	32	321	....	....	....
Sci. Coll., Tokyo.	4	Male[f]..	Pescadores Islands.	Feb. —,	T. Tada......	27	37	301	49	8	1
Imp. Mus., Tokyo.	14	Female[g]	Miyakoshima..	....	....	27	35	330	39	7	1–2
Do.......	29	Male[h]...	Okinawa shima, Riu Kiu.	....	....	25	33	323	43	7	1
Hamburg....	2574*a*	....	Iriomote shima, Riu Kiu.	1897. Mar. 13	Lenz..........	23	34	....	....	....	1
Do.......	2574*b*	....	.....do..........	.....do....	.....do........	24	32	....	....	....	1
Leiden.......	1483	....	"Japan".......	....	von Siebold...	25	35	341	51	....	1

[a] Description, p. 422.
[b] Figs. 341–344.
[c] Boettger, p. 111.
[d] Type.
[e] Boulenger, MS. cat.
[f] Figs. 338–340.
[g] Figs. 345–347.
[h] Type of *D. orientalis*. Description, p. 423; figs. 348–349.

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[a] The specimen in question (No. 1483) was examined by me in 1898; for the permission to do so thanks are due to the director, Doctor Jentink. It was labeled as stated above, and the count of ventrals and subcaudals gave respectively 341 and 51 scutes. These figures, however, agree only with the third specimen mentioned by Schlegel (Phys. Serp., II, p. 504), who states that this is the one collected by Buerger. Whatever error may have crept in, there can be but little doubt that the specimen was collected practically in the same waters as the others.

[DISTEIRA FASCIATA[a] (Schneider).]

1799. *Hydrus fasciatus* Schneider, Hist. Amph. I, p. 240 (type-locality, unknown; types in Berlin Mus., Nos. 2836–2837).—*Disteira fasciata* Fitzinger, Neue Class. Rept., 1826, p. 55 (India).—*Hydrophis fasciatus* Peters, Mon. Ber. Berlin Akad. Wiss., 1872, p. 849, pl. i, fig. 1 (types, description).—Boulenger, Cat. Snakes Brit. Mus., III, 1896, p. 281 (coasts of India to China and New Guinea).

1837. *Hydrophis gracilis* Schlegel, Phys. Serp., II, p. 507 (part: Padang, Sumatra) (not *Hydrus gracilis* Shaw, 1802).—Jan, Icon. Ophid., livr. 41, 1872, pl. iv, fig. 2 (Java).

1842. *Aturia lindsayi* Gray, Zool. Misc. (p. 61) (type-locality, China; type in Brit. Mus.; W. Lindsay, coll.).

1864. *Hydrophis chloris* Guenther, Rept. Brit. India, p. 370 (not *H. cloris* Daudin, 1803) (Madras; Pinang).

For the characters supposed to separate this species see the "key" (p. 420) and the discussion under the foregoing species (p. 421). In view of the statements there made a detailed description is deemed superfluous.

Habitat.—Boettger has recorded *Hydrophis fasciatus* from Miyakoshima, but I have given my reasons elsewhere (p. 422) for referring this specimen to *D. melanocephala*. Under these circumstances this species has no standing in the Japanese fauna, but I have included its synonymy here because of the uncertainty of the status of this and allied forms.

As generally understood, *D. fasciata* has a wide distribution from the coasts of India to the Philippines.

[DISTEIRA GRACILIS[b] (Shaw).]

1802. *Hydrus gracilis* Shaw, Gen. Zool., III, Pt. 2, p. 560 (type-locality not given).—*Disteira gracilis* Fitzinger, Neue Classif. Rept., 1826, p. 55 (India).—*Microcephalophis gracilis* Lesson, in Bélanger's Voy. Ind. Orient., Rept. (p. 321), Atlas, Rept., 1834, pl. iii (Bay of Bengal).—*Hydrophis gracilis* Guenther, Rept. Brit. India, 1864, p. 373 (Madras).—Boulenger, Cat. Sn. Brit. Mus., III, 1896, p. 280 (Persia to Malay Archipelago).—*Hydrophis* (*Microcephalophis*) *gracilis* Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 90 (Hainan).

1827. *Hydrophis kadell-nagam* Boie, Isis, 1827, p. 554 (based on Russell's Ind. Serp., II, pl. xiii).

1852. *Thalassophis microcephala* Schmidt, Abh. Naturw. Ver. Hamburg, II, Pt. 2, 1852, p. 78, pl. ii (type-locality, Java; types in Hamburg Mus.).—*Hydrophis microcephalus* Duméril and Bibron, Erpét. Gén., VII, Pt. 2, 1854, p. 1356 (Pondichéry).—*Hydrophis microcephala* Fischer, Abh. Naturw. Ver. Hamburg, III, 1856, p. 52 (Java).

1856. *Hydrophis leprogaster* Duméril and Bibron, in Fischer, Abh. Naturw. Ver. Hamburg, III, 1856, p. 53 (substitute for *Th. microcephala;* type-locality, Pondichéry; type in Paris Mus.).

The differentiating characters of this species being chiefly those of proportion and scale formula, a detailed description is not necessary in the present connection. The essential points may be gathered from the "key" (p. 420).

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[a] Signifying banded.

[b] Signifying slender.

Habitat.—The slender sea snake has a wide distribution from the Gulf of Omar, between Arabia and Persia, to the Malay Archipelago and the South China Sea.

It has been recorded as far north as the island of Hainan and Macao, but not yet from Japanese waters. It is included here, however, to help identification in case its range extends that far.

DISTEIRA CYANOCINCTA[a] (Daudin).

1803. *Hydrophis cyanocinctus* Daudin, Hist. Nat. Rept., VII, p. 383 (type-locality, Bengal; based on Russell's Ind. Serp., II, pl. IX).—Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 88 (Hainan).—*Hydrophis cyanocincta* Hilgendorff, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, July, 1876, p. 31.—*Distira cyanocincta* Boulenger, Fauna Brit. India, Rept., 1890, p. 410; Cat. Sn. Brit. Mus., III, 1896, p. 294 (Persian Gulf to Japan; Formosa).—West, Proc. Zool. Soc. Lond., 1895, p. 823, pl. LXVI, figs. 1, 8, 17 (poison gland; maxilla).—Wall, Proc. Zool. Soc. London, 1903, pp. 96, 101 (Hongkong).

1804. *Leioselasma striata* Lacépède, Ann. Mus. d'Hist. Nat., Paris, IV, p. 210, pl. LVII, fig. 1 (type-locality, "Nouvelle Hollande").—*Hydrophis striata* Schlegel, Phys. Serp., II, 1837, p. 502, pl. XVIII, figs. 4–5 (Japan Seas); Fauna Japon., Rept., 1837, p. 89 (part), Oph. et Saur., pl. VII (Japan Seas).—Okada, Cat. Vert. Japan, 1891, p. 69 (Okinawa Sea).

1817. *Hydrophis chittal* Rafinesque, Amer. Month. Mag., I, p. 432 (India; based on Russell).

1849. *Hydrophis subannulata* Gray, Cat. Sn. Brit. Mus., p. 54 (type-locality, India).

1849. *Hydrophis aspera* Gray, Cat. Sn. Brit. Mus., p. 55 (type-locality, Singapore; type in Brit. Mus.).

1859. *Hydrophis westermani* Jan, Rev. Mag. Zool., 1859, p. —; author's separate, p. 26, pl. E (type-locality, Indian Ocean; type in Mus. Milano).

1863. *Hydrophis westermanni* Jan, Elenco Sist. Ofid., p. 111 (emendation); Icon. Ophid., livr. 39, 1872, pl. V, fig. 1 (type).

1870. *Hydrophis trachyceps* Theobald, Cat. Rept. (p. 70).

1871. *Hydrophis crassicollis* Anderson, Journ. Asiat. Soc. Bengal, XL, 1871, (p. 19).

1887. *Hydrophis taprobanica* Haly, Taprobanian, II, (p. 107).

1887. *Hydrophis phipsoni* Murray, Journ. Bombay Nat. Hist. Soc., II, (p. 32, pl. —).

Description.—Adult female; U.S.N.M. No. 33931; Inatori, Idzu, Hondo, Japan; December 22, 1903; A. Owston collection (fig. 351). Rostral nearly as high as broad, the portion visible from above about as long as interprefrontal suture; nasals large, the suture between them twice as long as that between prefrontals; nostril in outer posterior corner of nasal; prefrontals not larger than supraoculars with which they are broadly in contact; frontal long, longer than its distance from rostral, but shorter than that from tip of snout, slightly broader than supraoculars; parietals longer than frontal, the interparietal suture equaling the distance of frontal from rostral; no loreal; one preocular; eye small, not larger than preocular; two postoculars; two anterior oblique temporals, the lower one being the upper cut-off portion of fifth (sixth on right side) supralabial; 7 supralabials on left side, 8 on right, second largest, fifth, sixth, and seventh (sixth, seventh, and eighth on right side), very low, subequal, third and fourth (third and fifth on right side, the interpolated fourth not reaching the orbit) entering eye; 3 lower labials in contact with anterior chin-shields which equal the posterior pair, the latter in contact throughout; 33 rows of scales on neck, 41 on middle of body, the latter with a bituberculate keel; 329 ventrals which are nearly smooth; four elongate, subequal anals; 38 subcaudals; tip of tail with a slightly enlarged scale. Color (in alcohol) pale yellowish, back suffused with gray, the skin between scales black; 53 dark gray crossbands, broadest and darkest, nearly black, on back, 5 on tail; top of head olive gray fading into a paler tint on labials and throat.

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[a] Signifying blue-belted.

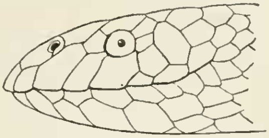

FIG. 351.—DISTEIRA CYANOCINCTA. 1⅓ × TIMES NAT. SIZE. SIDE VIEW OF HEAD. NO. 33931, U.S.N.M.

Dimensions.

Head small, neck fully as wide, body very elongate, its greatest height not far from the vent, posteriorly considerably compressed.

	mm.
Total length	1,290
Snout to vent	1,180
Vent to tip of tail	110
Width of head	14
Diameter of neck	15
Greatest height of body	46
Greatest height of tail	24

The *male* is less elevated behind and the scales and ventrals strongly tuberculate.

Variation.—Of the head shields probably the supralabials are subject to the greatest variation, 7 being the normal, while the eighth may be interpolated at various points and thus make the formula appear more unstable than it really is. The arrangement of the anterior temporals is characteristic; the difference from that of *D. melanocephala* was pointed out under the latter species. The coloration is rather variable inasmuch as occasionally specimens have been found having the upper surface uniformly dark without cross-bands or rings, while on the other hand individuals having a black longitudinal band along the underside uniting the dark rings are common.

Habitat.—This is one of the most widely distributed and commonest of the sea snakes, extending as it does from the mouth of the Euphrates in the Persian Gulf and Maskat in Arabia to Japan and, according to Peters, even to the Kingsmill Islands (Gilbert Archipelago) in the east.

Whether the specimen figured in Fauna Japonica (Plate VII) be the one collected by von Siebold or by Buerger (see p. 426 under *D. melanocephala*) there can be but little doubt that it was taken in Japanese or rather in Riu Kiuan waters. That it is rather common around Formosa seems proven by five specimens in British Museum collected by Swinhoe.

Stray specimens may occasionally drift far enough north to be taken in Japan proper as is shown by the specimen in the U. S. National Museum which was taken off Inatori, Idzu, on December 22, 1903.

List of specimens of Disteira cyanocincta.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows on neck.	Tcale rows on body.	Ventrals.	Subcaudals.	Supralabials.	Anterior temporals.
U.S.N.M	33931	Female[a]	Inatori, Idzu, Hondo.	1903. Dec. 22	A. Owston	33	41	329	38	7-8	2
Brit. Mus	*Ag*	Female[b]	Formosa		R. Swinhoe			310			
Do	*Ah*	Young[b]	do		do			308			
Do	*Ai*	do.[b]	do		do			305			
Do	*Ak*	do.[b]	do		do			303			
Do	*Ch*	Female[c]	do		do			330			

[a] Description, p. 428. [b] Boulenger, Cat. III, p. 295. [c] Boulenger, Cat. III, p. 296.

DISTEIRA GODEFFROYI[a] (Peters).

1872. *Hydrophis godeffroyi* PETERS, Mon. Ber. Berlin Akad. Wiss., 1872, p. 856, pl. I, fig. 3 (type-locality, Kingsmill Islands; types in Berlin Mus.).—*Distira godeffroyi* BOULENGER, Cat. Snakes Brit. Mus., III, 1896, p. 291 (2 specimens Brit. Mus., loc. unknown).

1903. *Distira ornata* WALL, Proc. Zool. Soc. London, 1903, pp. 95, **101** ("Loo Choos") (not of Gray, 1842); 1905, II, p. 517 (Okinawa).

Four specimens from Ishigaki shima I refer to *D. godeffroyi* with considerable hesitation.[b] They have the maxillary teeth following the poison fang distinctly grooved, and no doubt they are properly located among the species included by Boulenger in the genus *Disteira*. Doctor Wall, who examined them while yet in Mr. Owston's possession, identified them as *D. ornata* and recorded them under that name in the Proceedings of the Zoological Society of London for 1903. They can not well be referred to that species because of the small number of scale rows, especially around the neck. Their scale formula agrees well with that of *D. major*, which seems to have the same distribution as *D. ornata*, but their rostral is much broader than high, as is the case in the latter and not as broad as high. They also agree in many respects with *D. cyanocincta*, which occurs as far north as Formosa at least, but the maximum of their ventrals is 246, while the minimum of ventrals in the latter species is said to be 281, and, save in exceptional cases, above 300. In Boulenger's synopsis of the species,[a] *D. cyanocincta* on the one hand and *D. ornata, major*, and *godeffroyi* on the other are distinguished by the latter having the "second pair of chin-shields, if distinct, separated by several scales," while in the former they are said to be "in contact on the middle line" "or separated by a single scale," but evidently this distinction does not hold, at least not for the present species. Peters, in the original description of *D. godeffroyi*, expressly states that in the larger specimen of the types both pairs of chin-shields are in contact, while in the smaller one the posterior pair is separated by two scales which are pointed anteriorly. In our four specimens scarcely two are exactly alike, though there can not be the faintest doubt that they all belong to the same species. One (No. 33934) has the two posterior chin-shields in contact; in two (Nos. 33933, 33935) they are separated by one, and to some extent also by a second scale, while in the fourth (No. 33936) they are separated by two scales exactly shaped as described by Peters.

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[a] In honor of the German merchant, Johann Cesar Godeffroy (born in Kiel, July 1, 1813; died in Hamburg, Feb. 9, 1885) who in 1861 founded the Museum Godeffroy. The museum which was finally dispersed after his death was devoted mostly to Polynesian zoology and anthropology.

[b] This hesitation does not refer to the specimens in British Museum from an unknown locality and named *D. godeffroyi* by Boulenger, but to the species as originally described by Peters from the Kingsmill Islands.

The distance from the type locality, the Kingsmill, or Gilbert Islands, is certainly considerable, but so little has been collected in the intermediate region that no adverse argument can be derived from the remoteness of the Riu Kiu Islands.

In one sense our specimens are intermediate between all the species mentioned. This has already been demonstrated with regard to the relations of the posterior chin-shields. In the number of scales around the neck (viz, 30–34) they assume a position between *D. cyanocincta*, with 27–33, and *D. ornata*, with 35–42. In scales around the body (33–43) they agree better with *D. cyanocincta* (39–43) than with *D. ornata* (40–50), while in the number of ventrals (227–246) they come within the limits of the latter (210–300) and not within the former (281–426).[b] It is just possible that the case is similar to the one pointed out under *D. fasciata* and *melanocephla* (p. 421) and that the limits of the three species are not properly defined.

It may be that the distinction is not so much one of scale formula as of other characters. Thus, according to Boulenger. *D. major*, with which our species agrees best in scale formula, has the rostral "as deep as broad," and only one pair of chin-shields, while ours has the rostral much broader than high and the second pair of chin-shields well developed. In *D. ornata* this feature is apparently not so marked, for Boulenger speaks of the "posterior chin-shields, if distinct, separated by two or three scales." In *D. cyanocincta* the rostral is but "slightly broader than deep," and the scales "subimbricate,"[a] while in our specimens the difference between breadth and depth of the rostral is considerable and the scales can not be termed subimbricate on the posterior part of the body at least. I do not know whether the size of the terminal scale of the tail is of any consequence. Boulenger does not mention it in his descriptions, but in Jan's figure[b] which Boulenger cites under *D. ornata* it is quite large, while in our specimens no such enlarged terminal scale is differentiated. Peters expressly mentions that in *D. godeffroyi* the terminal tail scales are small.

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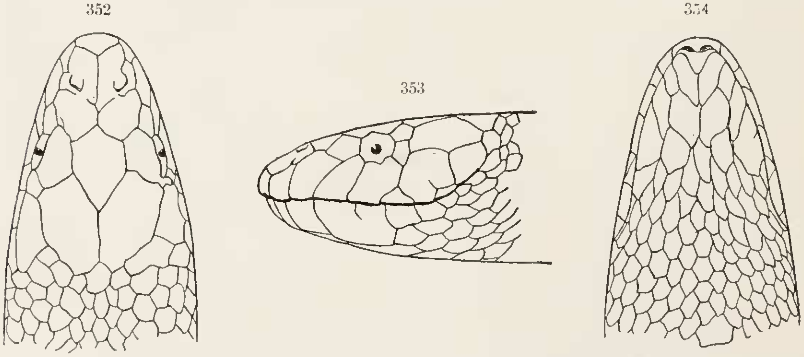
[a] Cat. Sn. Brit. Mus., III, 1896, pp. 286–287.

[b] The type specimens of *D. godeffroyi* are said to have 294 and 284 ventrals, respectively, consequently more than the exceptional minimum of a few *D. cyanocincta*.

I may add that our specimens agree on the whole very well with Peters's figures, except that the first supralabial is considerably higher than shown in his fig. 3. The anal shield, or scales (fig. 3*d*), agree exactly with the arrangement in our female (No. 33933), while in the three males there are four rows of small scales between the lateral large scutes instead of two. This arrangement of the preanals, together with the greater relative shortness of the body, seems to be among the best characters of this species.



FIGS. 352-354.—DISTEIRA GODEFFROYI. 1⅓ × NAT. SIZE. 352, TOP OF HEAD; 353, SIDE OF HEAD; 354, UNDERSIDE OF HEAD. No. 33933, U.S.N.M.

Description.—Adult female: U.S.N.M. No. 33933; Ishigaki shima, Yaeyama group, Riu Kiu archipelago; April to May, 1899; A. Owston collection (figs. 352–354). Rostral much broader than high, well visible from above; nasals long, with the crescentic valvular nostril close to the posterior edge; internasal suture as long as interparietal suture and three times as long as the one between the prefrontals;

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[a] "Scales all imbricate" in key. Cat. Sn. Brit. Mus., III, 1896, p. 287.

[b] Icon. Ophid., livr. 40, pl. vi, fig. 1.

frontal as long as its distance from rostral, once and a half as long as wide, shorter than parietals; parietals as long as frontal and interprefrontal suture together; no loreal; one preocular; two postoculars; 8 supraoculars, seventh and eighth very small and low, fifth a low triangular piece separated off from sixth, second in contact with prefrontal, very high and large; 3 lower labials in contact with anterior pair of chin-shields which are larger than posterior, the latter separated by two scales; 34 rows of slightly tuberculated scales on neck, 43 on middle of body, the tubercles on the latter more strongly developed; 246 bituberculated ventrals; preanal region covered with scales, four of which form the anterior edge of the vent, the outer ones on each side slightly longer than the others; 39 subcaudals; terminal scale of tail but slightly enlarged. Color (in alcohol) buffy white with a tinge of gray on the back and throat; 46 slaty-gray crossbars on neck and body and 8 on tail, broadest on middle of back, where broader than the light interspaces, gradually narrowing to the middle of the sides whence they extend as narrow, paler-colored bands to the abdomen, which many of them cross; head nearly uniformly isabella-colored; the last three bands on the tail blackish.

Dimensions.

Head rather large; neck thick; body short, high, and very compressed.

	mm.
Total length	790
Snout to vent	690
Vent to tip of tail	100
Width of head	19
Diameter of neck	19
Greatest height of body	51
Greatest height of tail	27

The *males* are much slenderer posteriorly, the greatest height of body being less than twice as high as the neck.

Variation.—Under the preliminary discussion of this species (p. 431) reference is made to the variation of chin-shields and number of ventrals in this species. The supralabials are also subject to considerable variation, chiefly caused by the irregular breaking up of the posterior shields and the consequent uneven arrangement of the fragments edging the lip. This irregularity in the posterior supralabials also affects the adjacent temporals inasmuch as a shield becomes a labial or a temporal according to whether the lower portion of it is cut off so entirely as to exclude the upper portion from the edge of the lip, or not.

Habitat.—The distribution of *D. godeffroyi*, as here understood, is a curiously disconnected one, inasmuch as the only specimens referred to it are known from the Kingsmill Islands in Polynesia, and from

Ishigaki shima in the Riu Kiu Archipelago, while the other two specimens in British Museum have no locality attached to them. Doctor Wall now records three from Okinawa.

List of specimens of Disteira godeffroyi.

U.S.N.M. No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Scale rows on neck.	Scale rows on body.	Ventrals.	Subcaudals.	Supralabials.	Anterior temporals.
			1899.							
33933	Female [a]	Ishigaki I., Riu Kiu	April-May.	A. Owston	34	43	246	39	7-8	1
33934	Male	do	do	do	30	35	228	45	7-8	2
33935	do	do	do	do	32	33	235	44	7	2
33936	do	do	do	do	33	33	227	42	8	2-1

[a] Description, p. 432; figs. 352-354.

[DISTEIRA VIPERINA [a] (Schmidt).]

1852. *Thalassophis viperina* Schmidt, Abh. Naturw. Ver. Hamburg, II, Pt. 2, p. 79, pl. III (type-locality, Java; type in Hamburg Mus.).—*Hydrophis* (*Thalassophis*) *viperinus* Boettger, Offenbach. Ver. Naturk. 26-28 Ber., 1888, p. 91 (Hainan).—*Distira viperina* Boulenger, Fauna Brit. India, Rept., 1890, p. 413; Cat. Sn. Brit. Mus., III, 1896, p. 298 (Maskat to Hongkong).—Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 114 (Hainan).

1854. *Disteira præscutata* Duméril and Bibron, Erpét. Gén., VII, Pt. 2, p. 1331 (type-locality unknown; type in Paris Mus.).

1856. *Hydrophis doliata* Fischer, Abh. Naturw. Ver. Hamburg, III, p. 56 (Schmidt's type of *T. viperina;* not of Lacépède, 1804).

1887. *Hydrophis jayakari* Boulenger, Ann. Mag. Nat. Hist. (5), XX, p. 408 (type-locality, Maskat, Arabia; type in Brit. Mus.; Doctor Jayakar, collector).

1887. *Hydrophis plumbea* Murray, Journ. Bombay Nat. Hist. Soc., II (p. 34).

No specimen of this species being at hand, I submit the diagnosis given by Boulenger in the Catalogue of Snakes.

Diagnosis.—Head rather small; body moderately elongate, rather slender anteriorly; rostral as deep as broad; nasals as long as or a little shorter than the frontal; suture between the prefrontals very short; frontal as broad as long, as long as its distance from the rostral or end of the snout, shorter than the parietals; one or two pre- and one or two postoculars; 7 or 8 upper labials, second largest, fourth or third and fourth entering the eye; one or two anterior temporals; two pairs of chin-shields, in contact with each other, posterior longest; 27 to 29 scales round the neck, 37 to 43 round the body; scales juxtaposed, obtusely keeled; ventrals relatively large anteterorly, bituberculate in the male, 235-267. Slaty gray above, with rhomboidal transverse black spots, white or pink on the sides and inferiorly; some specimens uniform dark gray above; in the young, the black spots are continued down the sides of the body; end of tail black.

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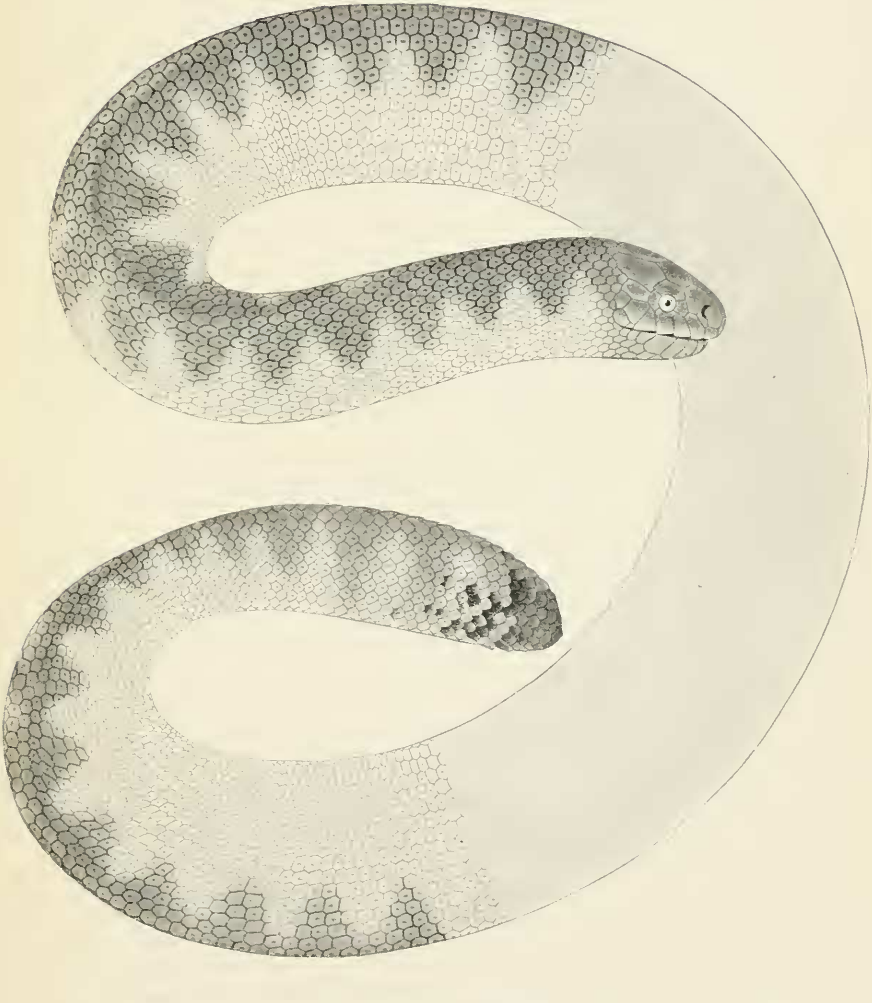
[a] Signifying viper-like.



Lapemis hardwickii. (From Jan.)

For explanation of plate see page 555.

Dimensions.

	mm.
Total length	920
Snout to vent	820
Vent to tip of tail	100

Habitat.—Distributed from Arabia in the west to China in the east, though apparently rather rare.

British Museum has one specimen from Hongkong, and Herz collected one at Hainan, which is now in the Senckenberg Museum.

It has not yet been recorded from any locality within our territory, but it seems highly probable that it occurs around Formosa at least occasionally.

[Genus LAPEMIS [a] Gray.]

1820. *Enhydris* Merrem, Syst. Amph., p. 140 (part; not of Latreille, 1802).
1834. *Lapemis* Gray, Ill. Ind. Zool., II (pl. lxxxvii, fig. 2) (type, *L. hardwickii*).
1861. *Pelamydoidis* Fitzinger, Sitz. Ber. Akad. Wiss. Wien, Math.-Nat. Cl., XLII, p. 409 (type, *Hydrophis pelamidoidis* Schlegel).

Apart from the fact that Merrem's *Enhydris* of 1820 is preoccupied by Latreille for an entirely different kind of snake, that name can not be used for a genus with *Hydrus curtus* for type, as restricted by Boulenger in 1890, because Wagler, as early as 1830, restricted it to *H. cyanocinctus*, one of the species included by Merrem in his *Enhydris*.

[LAPEMIS HARDWICKII [b] Gray.]

Plate XXIV.

1834. *Lapemis hardwickii* Gray, Ill. Ind. Zool., II (pl. lxxxvii, fig. 2) (type-locality, India; type in Brit. Mus.; Hardwicke, collector).—*Hydrophis hardwickii* Guenther, Rept. Brit. India, 1864, p. 380, pl. xxv, fig. w (type-locality, Pinang?).—Mueller, Verh. Naturf. Ges. Basel, VII, Pt. 1, 1882, p. 170; author's separate (p. 7) (China Sea).—*Enhydris hardwickii* Boulenger, Fauna Brit. India, Rept., 1890, p. 397; Cat. Sn. Brit. Mus., III, 1896, p. 301 (Bay of Bengal to Chinese Sea and New Guinea).—Wall, Proc. Zool. Soc. London, 1903, p. 96 (Manila; Bangkok).
1837. *Hydrophis pelamidoides* Schlegel, Phys. Serp., I, p. 187; II, p. 512 (Bay of Bengal, and seas of China and of the Moluccas); Atlas, pl. xviii, figs. 16–17; Fauna Jap., Rept., 1837, p. 91; Ophid., pl. ix (seas south of Japan).—Jan, Icon. Ophid., livr. 41, 1872, pl. iii, fig. 1 [c] (Indian Ocean).—Boettger, Offenbach. Ver. Naturk. 17–18 Ber., 1878, p. 8 (Japan).—Okada, Cat. Vert. Japan, 1891, p. 69 (Okinawa Sea).
1843. *Lapemis loreatus* Gray, Ann. Mag. Nat. Hist., XI (p. 46) (type-locality, Borneo; type in Brit. Mus.; Belcher, collector).
1856. *Hydrophis* (*Pelamis*) *pelamidoides* var. *annulata* Fischer, Abh. Naturw. Ver. Hamburg, III, p. 67, pl. iii (Java; Hamburg Mus.).
1863. *Hydrophis abbreviatus* Jan, Elenco Sist. Ofid., p. 109 (type-locality, Manila; type in Essex Inst., Salem, Mass.); Icon. Ophid., livr. 40, 1872, pl. iv, fig. 2.
1863. *Hydrophis brevis* Jan, Elenco Sist. Ofid., p. 109 (type-locality, Manila; type in Mus. Milano); Icon. Ophid., livr. 40, 1872, pl. v, fig. 2.

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[a] Anagram of *Pelamis*.

[b] For Gen. Thomas Hardwicke, who collected the type.

[c] Reproduced in this work on Plate XXIV.

1871. *Hydrophis fayreriana* Anderson, Journ. Asiat. Soc. Bengal, XL, Pt. 2, 1871 (p. 19).
1876. *Hydrophis pelamoides* Hilgendorf, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, p. 31 (*lapsus*).
1885. *Hydrophis hardwicki* Boettger, Offenbach. Ver. Naturk. 24–25 Ber., p. 155 (emendation).
1888. *Hydrophis hardwickei* Boettger, Offenbach. Ver. Naturk. 26–28 Ber., p. 150 (emendation).

Jan's *Hydrophis problematicus* (Rev. Mag. Zool., 1859, author's separate, p. 25) with 27 scale rows on the highest part of the body and 230 ventrals, can not well be this species. It is said to be from Manila.

There being no specimen from the waters adjacent to our territory available for description a modified copy of Boulenger's diagnosis in his Catalogue of Snakes is deemed sufficient for identification.

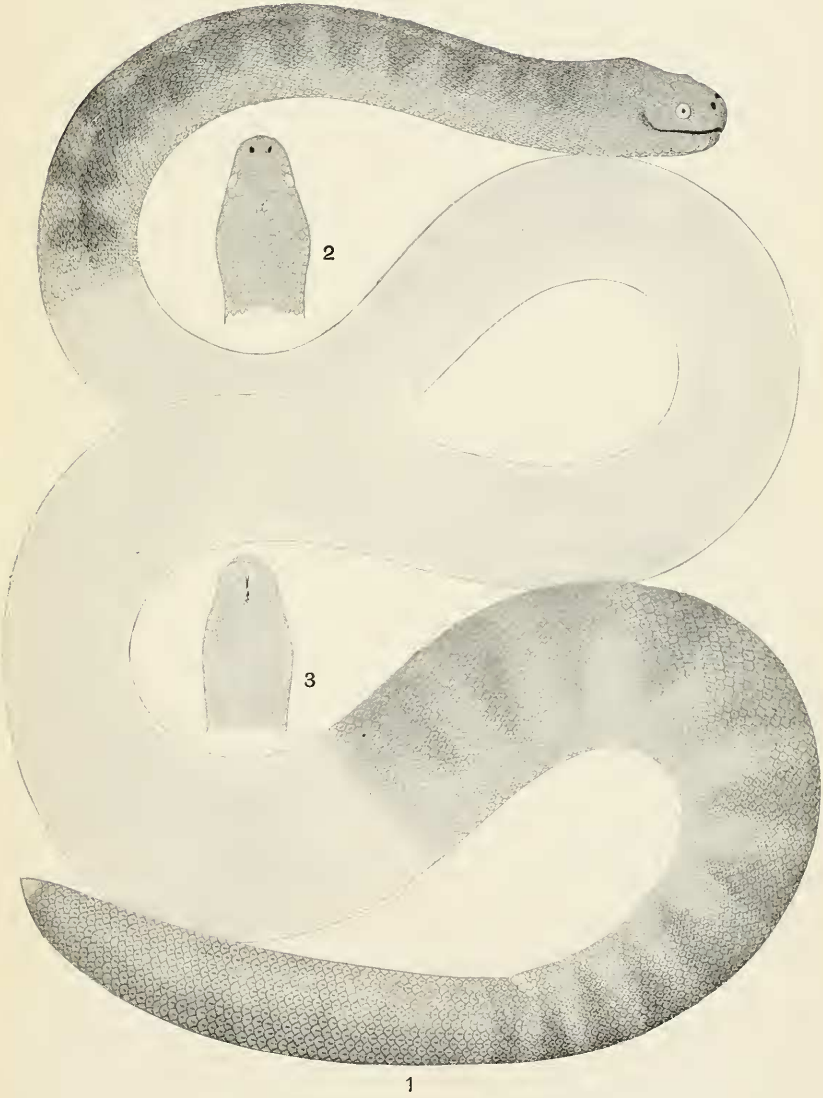
Diagnosis.—Rostral as deep as broad or slightly broader than deep; parietals large; one pre- and one to three postoculars; a loreal sometimes present; two or three superposed anterior temporals; 7 supralabials, fourth or third and fourth entering eye; chin-shields very small and separated by scales, or quite indistinct; 25 to 33 scales round the anterior part of the body, 34 to 37 round the middle, with tubercles [very feebly developed or a short keel]; ventrals usually very indistinct, 130–200. Coloration [above with dark transverse bands, broadest in the middle; these bands] often forming complete rings round the body.

Dimensions.

	mm.
Total length	750
Snout to vent	670
Vent to tip of tail	80

Habitat.—The claim of *Lapemis hardwickii* to a place in the Japanese fauna is doubtful. Schlegel enumerates and figures the species in Fauna Japonica, as *Hydrophis pelamidoides*, but the only reason given in the text is as follows: "A specimen of this curious reptile, collected in the seas south of Japan, has recently been brought to Holland. We hesitate the less in admitting this *Hydrophis* among the number of animals belonging to the fauna of Japan, inasmuch as it furnishes us an opportunity for publishing an exact figure of this species." The implication is that the specimen was not actually taken in Japanese waters, and so far as I know no later capture is on record. However, Mueller reports recently a specimen in the Basel Museum from the China Sea, and as the species appears to be common on the west side of Luzon, there is every chance that it may eventually be taken within our limits.

To the west the species is known in the Bay of Bengal and in the south to the coasts of New Guinea and Java.



Enhydrina valakadyn. (From Jan.)

For explanation of plate see page 555.

[Genus ENHYDRINA[a] Gray.]

1834. *Polyodontes* Lesson, in Bélanger's Voy. Indes Orient., Rept. (p. 325); Atlas, Rept., pl. IV (type, *P. annulatus*) (not *Polydontes* Montfort, 1810, nor *Polyodonta* Megerle, 1812).
1849. *Enhydrina* Gray, Cat. Sn. Brit. Mus., p. 47 (type, *Hydrus valakadyn*).

[ENHYDRINA VALAKADYN[b] (Boie).]

Plate XXV.

1827. *Hydrus valakadyn* Boie, Isis, 1827, p. 554 (type-locality, Tranquebar, India).
1827. *Disteira russelii* Fitzinger, Isis, 1827, p. 733 (based on Russell's Ind. Serp., II, pl. XI).
1834. *Polyodontes annulatus* Lesson, in Bélanger's Voy. Indes Orient., Rept. (p. 325); Atlas, Rept. pl. IV (type-locality, ———).
1837. *Hydrophis schistosa* Schlegel, Phys. Serp., II, p. 500; Atlas, pl. XVIII, figs. 1–3 (not of Daudin, 1803).—*Hydrophis schistosus* Jan, Icon. Ophid., livr. 41, 1872, pl. II, fig. 1[c] ("Japan;" Mus. Milano).
1842. *Hydrophis bengalensis* Gray, Zool. Miscell., p. 62 (type-locality, Bengal; type in Brit. Mus.; Hardwicke, collector).
1842. *Hydrophis subfasciata* Gray, Zool. Miscell., p. 62 (type-locality, Bengal; type in Brit. Mus.).
1849. *Enhydrina valakadyen* Gray, Cat. Sn. Brit. Mus., p. 48 (emendation).
1872. *Hydrophis fasciatus* Jan, Icon. Ophid., livr. 41, pl. III, fig. 2 (Bay of Bengal) (not of Schneider).
1890. *Enhydrina valakadien* Boulenger, Fauna Brit. India, Rept., p. 406 (emendation); Cat. Sn. Brit. Mus., III, 1896, p. 302 (Persian Gulf to Papuasia).
1892. *Enhydrina vikadien* Boettger, Offenbach. Ver. Naturk. 29–32 Ber., p. 89 (*lapsus*) (Madras).
1899. *Enhydrina velakadien* Flower, Proc. Zool. Soc. London, 1899, p. 688 (*lapsus*) (Siam).

This is possibly the snake which von Siebold meant when mentioning "*Hydrophis flaviventris* mihi," referring as he does to Bosc's "Hydrophis ardoisé" (Nouv. Dict. d'Hist., Nat., XV, p. 491). The reference is found in a scarce pamphlet published by von Siebold in Batavia in 1824 under the title "De historiae naturalis in Japonia statu," etc. A reprint in pamphlet form was issued in Wuerzburg by some of his friends in 1826, and reference is also made to it in Oken's Isis for 1827. From these latter two issues has been taken the above reference, which is found on page 18 and page 142, respectively, the heading under which it occurs being Spicilegia Faunae Japonicae.

There is no specimen in our museum from Chinese or Japanese waters, and a detailed description of a specimen from a distant locality is not deemed satisfactory. For the purposes of identification a transcript of Boulenger's diagnosis in his Catalogue of Snakes is given.

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[a] Signifying like *Enhydris*, the generic name given by Latreille to another water snake.

[b] *Valakadyen* is the native name according to Russell, its first describer.

[c] Reproduced in this work on Plate XXV.

Diagnosis.—Rostral deeper than broad; frontal small, longer than broad, shorter than its distance from the end of the snout or than the parietals; one pre- and one or two postoculars; 7 or 8 supralabials, fourth or third and fourth entering the eye; usually a single anterior temporal; [symphysial shield narrow, partly concealed in a deep groove in the chin]; chin-shields small or indistinct; 40 to 60 scales round the neck, 50 to 70 round the body; scales feebly imbricate, with a small tubercle or short keel, which is stronger in the males; ventrals very slightly enlarged, 230–314. Young olive or gray above, with black transverse bands, broadest in the middle, and tapering to a point on the sides; in the adult these bands are usually less distinct, some specimens being uniform dark gray above; sides and lower parts whitish.

Dimensions.

	mm.
Total length	1,300
Snout to vent	1,110
Vent to tip of tail	190

Habitat.—The Valakadyen is introduced here mainly on the strength of a specimen recorded by Jan as being in the Milano Museum with the locality "Japan." This is ordinarily a very doubtful authority, and the chances are that the specimen was not taken in Japanese waters. Yet, with the possibility that it may be the species which von Siebold referred to in 1824 (see p. 437), I have thought it best to include a brief characteristic, as it may occasionally, at least, drift as far as Formosa, or farther, notwithstanding the fact that it has not been reported by others north of Cochin China.

This species is known from Arabia in the west to the Malay Archipelago, Papuasia, and Siam in the east. It is said to be "incredibly numerous" in the Bay of Bengal, at Pinang and Singapore.

Genus HYDRUS[a] Schneider.

1799. *Hydrus* Schneider, Hist. Amph., I, p. 233 (type, *H. bicolor*).
1802. *Hydrophis* Latreille, Hist. Nat. Rept., IV, p. 193 (substitute for *Hydrus* Schneider).
1803. *Pelamis* Daudin, Hist. Nat. Rept., VII, p. 357 (substitute for *Hydrophis* Latreille).
1830. *Pelamys* Wagler, Syst. Amph., p. 166 (emendation).
1848. *Elaphrodytes* Gistel, Naturg. Thierr., p. ix (substitute for *Hydrus*).

The type of *Hydrus*, as ascertained by the process of elimination, is *H. platurus*. Latreille changed the name *Hydrus* into *Hydrophis* simply because the French name "hydre" was preoccupied for another animal, the *Hydra*. It is, therefore, a synonym pure and simple and must have the same type as Schneider's *Hydrus*. Daudin's *Pelamis* of the following year has precisely the same status, as he invented another name for no other reason than "elles habitent dans la mer." *Hydrophis* and *Pelamis* are consequently unavailable as names for other genera.

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[a] From ὕδρος, a water snake.

HYDRUS PLATURUS[a] (Linnæus).

1766. *Anguis platura* Linnæus, Syst. Nat., 12 ed., I, p. 391 (type-locality unknown; type originally in Fr. Ziervogel's pharmacy, Stockholm).—*Hydrophis platura* Latreille, Hist. Nat. Rept., IV, 1802, p. 197 (islands of the Pacific Ocean).—*Hydrus platurus* Boulenger, Fauna Brit. India, Rept., 1890, p. 397; Cat. Sn. Brit. Mus., III, 1896, p. 267 (Indian and Pacific oceans: Ooshima, Loo Choo Is.; Formosa).—Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 112.—Stejneger, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 223 (Kilung, Formosa; Pescadores Is.).—Wall, Proc. Zool. Soc. London, 1903, pp. 95, 101 (Hongkong; Formosa; Loo Choos); 1905, II, p. 516 (Okinose, Sagami).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, 1905, p. 291 (Possiet Bay).

1788. *Anguis platuros* Gmelin, Syst. Nat., I, Pt. 3, p. 1122 (Pine Isle, Pacific Ocean; Forster, collector) (emendation).

1799. *Hydrus bicolor* Schneider, Hist. Amph., I, p. 242 (type-locality not specified; specimen in Mus. Blochianum).—*Pelamis bicolor* Daudin, Hist. Nat. Rept., VII, 1803, p. 366 (Bengal).—Swinhoe, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225 (Kelung, Tamsui River, Formosa).—Strauch, Mém. Acad. Sci. Pétersb. (7), XXI, no. 4, 1873, p. 199 (Possiet Bay, Siberian Coast Province).—Hilgendorf, Mitth. Deutsch. Ges. Ost.-Asiens, I, heft 10, July, 1876, p. 30 (Prov. Kaga, Hondo; Setanai, Prov. Kunashiri, Yezo).—Martens, Preuss. Exped. Ost.-Asien, Zool., I, 1876, p. 382 (Strait of Formosa).—Doederlein, Mitth. Deutsch. Ges. Ost-Asiens, III, heft 25, Dec. 1881, p. 210 (west coast of Hondo and Yezo).—Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 91 (Hongkong).—*Hydrophis* (*Pelamis*) *bicolor* Fischer, Abh. Naturw. Ver. Hamburg, III, 1856, p. 61 (Indian Ocean; west coast Mexico).—*Hydrophis bicolor* Jan, Icon. Ophid., livr. 40, 1872, pl. ii, fig. 4; pl. iii, fig. 2 (China Sea).—Okada, Cat. Vert. Japan, 1891, p. 69 (Noto; Hoki; Totomi; Idzumo).

1817. *Pelamis schneideri* Rafinesque, Amer. Month. Mag., I, p. 432 (substitute name for *Hydrus bicolor* Schneider).

1837. *Hydrophis pelamis* Schlegel, Phys. Serp., I, p. 187; II, p. 508; Atlas, pl. xviii, figs. 13–15 (substitute name); Fauna Jap., Rept., 1837, p. 90 (voyage between Java and Japan, north to 27° N. lat.).—Boettger, Offenbach. Ver. Naturk. 17–18 Ber., 1878, p. 8 (Japan).

1837. *Hydrophis pelamis* var. Schlegel, Fauna Jap., Rept., Ophid., pl. viii (Borneo).

1842. *Pelamis ornata* Gray, Zool. Miscell., p. 60 (type-locality, India; type in Brit. Mus.).

1854. *Pelamis bicolor* var. *variegata* Duméril and Bibron, Erpét. Gén., VII, Pt. 2, p. 1337 (Macassar, Celebes).—Jan, Icon. Ophid., livr. 40, 1872, pl. iii, fig 3.

1854. *Pelamis bicolor* var. *sinuata* Duméril and Bibron, Erpét. Gén., VII, Pt. 2, p. 1338 (locality unknown).

1856. *Hydrophis* (*Pelamis*) *bicolor* var. *alternans* Fischer, Abh. Naturw. Ver. Hamburg, III, 1856, p. 63 (substitute for var. *variegata*).

1863. *Hydrophis bicolor* var. *maculata* Jan, Elenco Sist. Ofid., p. 109 (Indian Ocean); Icon. Ophid., livr. 40, 1872, pl. iii, fig. 1.

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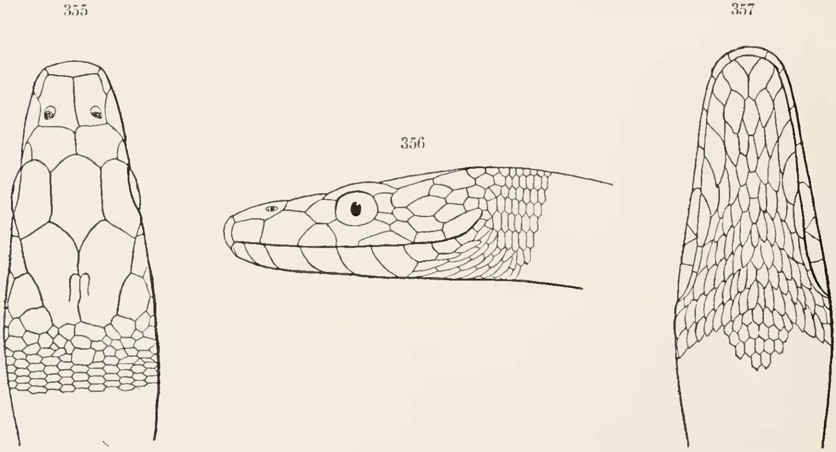
[a] From πλᾰτύς, flat; οὐρά, tail.

There are several well-marked color varieties which have received varietal names. Their exact status has not been made clear, but while it is true that they do not seem to represent local races, there is nevertheless a certain regularity in their distribution. Thus the ordinary black-backed form seems to be almost exclusive in the Pacific Ocean; spotted individuals, such as the one figured in Fauna Japonica, plate VIII (from the west coast of Borneo) appear to occur mostly in the Indian Ocean. All the specimens from eastern China, Formosa, Riu Kiu, and Japan, so far as the records show, are of the black-backed form.

Description (figs. 355–357).—*Adult female:* U.S.N.M. No. 17518; harbor of Nagasaki, Kiusiu; December 15, 1883; P. L. Jouy, collector. Head very depressed; snout elongate, the distance from eye to tip of snout equaling the width of head at posterior end of supraoculars; rostral nearly as high as broad, well visible from above; nasals not much longer than prefrontals, the suture between the former about twice as long as between the latter; frontal much longer than its distance from tip of snout and nearly as long as parietals, much wider than supraoculars; parietals long, with irregular outlines, a small intercalated shield in the suture between them; no loreal; a long preocular, pointed anteriorly; two suboculars; two postoculars; three anterior temporals; ten supralabials, second largest, in contact with prefrontals, fourth to tenth small and low, none entering eye; no differentiated chin-shields; 61 scale rows around middle of body, the scales hexagonal, juxtaposed, smooth; no differentiated ventrals or subcaudals; two slightly enlarged scales, one at each side in front of vent; terminal scale on tail somewhat enlarged. Color (in alcohol) on back dark seal-brown, sides and underparts abruptly clay-colored, the



Figs. 355–357.—Hydrus platurus. 1⅓ × nat. size. 355, top of head; 356, side of head; 357, underside of head. No. 8, Sci. Coll. Tokyo.

boundary between the two colors being a straight line until a short distance in front of the vent where it becomes wavy; top of head like back, supralabials like underside, lower labials washed with brown; tail straw-yellow, with a series of about six dark brown roundish blotches along the upper and the lower edge and a median series of smaller ones on the sides.

Dimensions.

	mm.
Total length	609
Snout to vent	528
Vent to tip of tail	81
Width of head across center of eyes	14
Length of shielded portion of head	31
Greatest height of body	38
Greatest height of tail	20

The *males* have a somewhat slenderer body, fewer scale rows, and the scales have a central tubercle.

Variation.—This species is exceedingly variable; especially the shields of the sides of the head are subject to so numerous modifications that it is hardly profitable to enumerate them in view of the striking appearance of this snake, which makes the identification of the species one of the easiest. It may be mentioned, however, that the supralabials may vary between 7 and 11; one or more loreals may be present; suboculars may be present or not; two anterior chin-shields may be sometimes recognized in a pair of enlarged scales never in contact, however. In our specimens the number of scale rows varies between 49 and 61, the higher figures belonging to the females, while Boulenger gives 45 to 47 as the normal number.

The coloration is also very variable, and mention has already been made of the spotted form from the Indian Ocean (p. 440). In the black-backed form which is the only one found in the eastern waters, the tail is most subject to variation, inasmuch as the spots on the upper and lower edges may join so as to form blackish cross-bands, or they may disappear on the lower edge entirely. In many specimens there may be seen on the sides between the blackish color of the back and the more or less dirty clay-color of the belly a broad yellow band.

Habitat.—Probably the most widely distributed species of snake, occurring as it does on all the coasts and islands of the Indian and Pacific oceans within the Tropics and even extending its range in many places considerably beyond the tropical waters, thus in the southern hemisphere to the Cape of Good Hope and to New Zealand. In the northern hemisphere it has been found on the eastern coasts of Asia as far north as Yezo and the Russian Coast Province

Beyond the tropics, however, these snakes are only carried occasionally by the warm currents. Thus while they are yet of regular occurrence around Formosa, they become gradually scarcer in the

Riu Kius, although stray individuals are picked up rather frequently on the coasts of Japan proper. A Formosan specimen is in British Museum collected by Swinhoe, and Mr. Tada also obtained it in that island and recorded it from the Pescadores Islands; British Museum furthermore has a specimen collected by Mr. Ferrié in Amami-o-shima, Riu Kiu, and Doctor Wall saw two or three more specimens in Mr. Owston's collection from the shores of the Riu Kius. Authentic records for Japan proper show specimens obtained on the eastern and the western shores. Thus Jouy collected one in the harbor of Nagasaki on December 15, 1883; Okada mentions it as having been found in the provinces of Idzumo, Hoki, and Noto, and Hilgendorf records a specimen from the province of Kaga, all in Hondo, in the Sea of Japan; the latter author also mentions having seen a specimen from "Setanai (Prov. Kunasiri)"[a] in the exhibition of the government of Hokkaido. Doederlein mentions another specimen from Yezo, probably also from the west coast.

From the east coast we have in the U. S. National Museum two specimens from the Bay of Sagami, one from the Bay of Suruga, and one from Inatori, province of Idzu, opposite O-shima; Doctor Wall mentions another specimen from Sagami Bay, and Okada records the species from Omaya Saki, province of Totomi.

On the mainland side of the sea of Japan, Dr. B. Dybowski collected a specimen in Possiet Bay, near the Korean boundary, the specimen, according to Strauch, being in the museum in Warsaw.

List of specimens of Hydrus platurus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.
U.S.N.M	17518	Female[a].	Nagasaki, Kiusiu	Dec. 15, 1883	P. L. Jouy	61
Do.	33932	Male	Inatori. Idzu, Hondo	Dec. 22, 1903	A. Owston	49
Do	33964	do	Sagami Bay, Hondo	Apr. —, 1902	do	52
Do	33965	Female	do	do	do	57
Do.	33966	Male	Suruga Bay, Hondo	Jan. 12, 1904	do	53
Sci. Coll. Tokyo	8	do.[b]	Kilung, Formosa	Nov. —, 1897	T. Tada	50

[a] Description p. 440.

[b] Figs. 355-357.

Family COBRIDÆ.

As will be seen from the explanation under the generic name of the only species of this family treated of in this work, the term *Vipera*, from which the family name *Viperidæ* is derived, must be superseded by *Coluber*. The confusion necessarily resulting from this transfer of the latter name would be still more far-reaching were we compelled to derive the new family name from it.[a] Under these circumstances it seems preferable to give a new family name derived from the generic term of the African vipers nearest related to the genus *Coluber*. This genus is Laurenti's *Cobra*, which is equivalent to *Bitis* given much later. To have adopted the family name *Causidæ* and giving it a much wider significance than intended by its originator would also lead to confusion.

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[a] Kunashiri is an island off the northeast extremity of Yezo, but I have been unable to find on my maps any locality of that name on Yezo itself. There is, however, a Setanai in the province of Shiribeshi, on the west coast of Yezo (about 42° 30′ N. lat.) which is possibly the place meant.

The chief characteristic of this group is the shortness of the maxillaries on which the large poison fangs are placed immovably. The maxillary bone is so connected with the other bones of the skull as to be readily movable in a vertical direction so that the fangs can be raised or folded back at will. This apparatus is essentially the same as that of the Crotalids and will be described more in detail under the latter, the chief difference being that in the vipers the maxillary is not scooped out, while in the Crotalids it has a deep hollow for the loreal pit.

The vipers are confined to the Old World and are found mostly in Africa. A number of forms also inhabit the palearctic region, one species thus coming within our province, while only a single viper inhabits the Indian region proper, and none the Malay archipelago or Australia.

Genus COLUBER[b] Linnæus.

1758. *Coluber* LINNÆUS, Syst. Nat., 10 ed., I, p. 216 (type, *C. berus*).
1768. *Vipera* LAURENTI, Syn. Rept., p. 99 (type, *V. illyrica*).
1820. *Pelias* MERREM, Syst. Amph., p. 148 (type, *Coluber berus*).
1820. *Berus* GOLDFUSZ, Handb. Zool., II, p. 144 (type, *Vipera berus;* not of Oken, 1816).
1822. *Chersea* FLEMING, Philos. Zool., II, p. 295 (type. *C. vulgaris*=*Coluber berus*).

The name *Coluber* was instituted by Linnæus in 1758 for the great majority of snakes and the "genus" so designated embraced poisonous as well as nonpoisonous snakes. The term since then has been applied to widely different groups of serpents, and there is hardly a name in ophiology which has been more in dispute, or attributed to more kinds of snakes than that of *Coluber*. It has been restricted so as to fall entirely within the *Pythonidæ*, the *Viperidæ*, or the aglyphodont Natricoids. All sorts of schemes for ascertaining the type to which the name might be fastened have been tried,[c] but without satisfactory results, and even the same author has at various times applied it to widely different genera.

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[a] According to the International Code, art. 5, "the name of a family or subfamily is to be changed when the name of its type genus is changed."

[b] General Latin term for snake.

[c] See, for instance, Cope, Proc. U. S. Nat. Mus., XI, p. 389.

In order to settle the question according to the International Code of Zoological Nomenclature we must turn to its article 30, which reads as follows:

> If the original type of a genus was not indicated, the author who first subdivides the genus may apply the name of the original genus to such restricted genus or subgenus as may be judged advisable, and such assignment is not subject to subsequent change. In no case, however, can the name of the original genus be transferred to a group containing none of the species originally included in the genus; nor can a species be selected as type which was not originally included in the genus, or which the author of the generic name doubtfully referred to it.

Linnæus, of course, did not indicate a type, and "the author who first subdivides the genus may apply the name of the original genus to such restricted genus or subgenus as may be judged advisable, and such assignment is not subject to subsequent change." The first one to do this is unquestionably Laurenti, in 1768. He dismembered the enormous genus *Coluber* of Linnæus and left comparatively few species in it. Five of these are additional to those included by Linnæus in his original *Coluber* of 1758, and are consequently ineligible as types, because a species can not "be selected as type which was not originally included in the genus." The type must of necessity, therefore, be selected from among the remaining Linnæan species, viz, *Coluber stolatus*, *buccatus*, *sibon*, *chersea*, and *berus*, the two last-mentioned being in reality only one species. It now so happens that only one of these has been designated by a subsequent writer as type of the genus *Coluber*, viz, *C. berus*, which was so designated by Prof. Robert Collett, in 1878,[a] and in the words of article 30 "such assignment is not subject to subsequent change."[b] The result is fully consonant with the "recommendation" accompanying article 30, more particularly that part of paragraph C, which provides that "if the genus contains both exotic and nonexotic species, from the standpoint of the original author, the type is to be selected from the nonexotic species," inasmuch as *C. berus* is the only nonexotic species among the eligible species. That this result also agrees with Laurenti's "intention" has been well shown by Cope,[c] who expressly remarks that "the poisonous species are, then, the types of the *Coluber* of Laurenti."

In a large collection of Russian and Siberian reptiles received by the United States National Museum in 1885 from Dr. Alexander Strauch there are three specimens named *Vipera berus* which in the invoice are marked thus: No. 32, Dui auf Sachalin; No. 84, Smeinogorsk (Altai); No. 88?, Dui auf Sachalin.

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[a] Christiania Vidensk. Selsk. Forhandl., 1878, no. 3, p. 6.

[b] It might even be maintained that the same selection was made as early as 1820 by Merrem (Syst. Amphib., p. 148). He subdivided also the genus *Coluber*, but unfortunately he did not retain the name for any of the subdivisions. But in instituting the genus *Pelias* for *Coluber berus* he expressly mentions Laurenti's *Coluber* as the equivalent.

[c] Proc. U. S. Nat. Mus., XI, p. 389.

The original parchment tags with the numbers are still attached to the specimens which represent two species as follows: No. 32 (U.S.N.M. No. 14325) *Coluber berus*; No. 84 (14324), *Coluber berus;* and No. 88 (14318), *Coluber renardi.* It should be noted that the question mark following 88 in the invoice is not found on the parchment tag; also that there is another No. 88, viz, a *Natrix hydrus*, from Mangyshlak, Transcaspia (U.S.N.M., No. 14327). This question mark in the invoice throws some doubt upon the accuracy of the whole entry rendering the locality Dui on the island of Sakhalin for *Coluber renardi* very dubious in the face of the fact that this species hitherto has not been recorded from any locality east of the Altai Mountains. On the other hand, it must not be forgotten that *Coluber berus* and *C. renardi* occur in the same localities in western Siberia, and that Strauch himself did not distinguish between the two species. Nevertheless, *C. renardi* can not be admitted to the fauna of Sakhalin upon the strength of our specimen alone, the locality of which must be regarded as erroneous until corroborated by additional material.

Coluber renardi[a] is quite distinct from *C. berus*. Our specimen (female) has 21 scale rows, 145 ventrals, and 25 subcaudals and shows all the characteristic features of the species, such as: Snout pointed, hollow with swollen canthal edge; one apical scale only in contact with the rostral; upper preocular long, anteriorly touching nasal; nostril small, located in the lower half of the nasal. The scutellation of the top of the head is almost identical with Boulenger's figure *c* on Plate LXIV.[b]

COLUBER BERUS[c] Linnæus.

1758. *Coluber berus* LINNÆUS, Syst. Nat., 10 ed., I, p. 217 (type-locality, Europe); 12 ed., I, 1766, p. 377.—LAURENTI, Syn. Rept., 1768, p. 97.—*Vipera berus* DAUDIN, Hist. Nat. Rept., VI, 1803, p. 89.—MIDDENDORFF, Sibir. Reise, II, II, Pt. 1. 1853, p. 247 (Udskoi Ostrog; sources of the Riv. Tugur).—STRAUCH, Mém. Acad. Sci. St. Pétersb. (7), XXI, no. 4, 1873, pp. 206, 279 (Ussuri; Hadshi Bay; Udskoi Ostrog; Uisut Island; Sakhalin; Nikolayevsk; Possiet Bay).—JAN, Icon. Ophid., livr. 45, 1874, pl. II.—NIKOLSKI, Zap. Imp. Akad. Nauk, S. Peterburg, LX, Prilozhen. no. 5, 1889, p. 290 (Sakhalin); Zap. Imp. Akad. Nauk, S. Peterburg (8), XVII, no. 1, 1905, p. 303 (Russia to Sakhalin).—BOULENGER, Ann. Mag. Nat. Hist. (6),

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[a] 1861. *Pelias renardi* CHRISTOPH, Bull. Soc. Nat. Moscow, XXXIV, Pt. 2, p. 599 (type-locality, Sarepta, SE. Russia).—*Vipera renardi* BOULENGER, Proc. Zool. Soc. London, 1893, pp. 598, 757, pl. LXIV (Southeastern Russia to eastern Turkestan); Cat. Sn. Brit. Mus., III, 1896, p. 475 (southern Russia and central Asia).

Named for councilor of State, Doctor Renard, then editor of the Bulletin of the Imperial Society of Naturalists of Moscow.

[b] Proc. Zool. Soc. London, 1893.

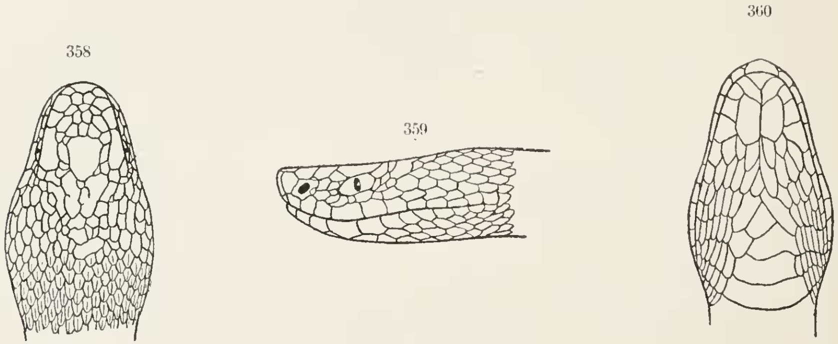
[c] *Berus* as the name of a water snake, probably *Natrix natrix*, is said to be used first by such medieval writers as Albertus Magnus, Vincent de Beauvais, etc.

V, Feb. 1890, p. 139 (Possiet Bay to Sakhalin); Cat. Sn. Brit. Mus., III, 1896, p. 476 (Sakhalin).—*Pelias berus* DOBROTVORSKI, Izvest. Sibir. Otd. Geogr. Obstchest., I, 1870 (p. 23) (Sakhalin).—DOEDERLEIN, Mitth. Deutsch. Ges. Ost-Asiens, III, heft 22, Dec. 1880, p. 89 (Sakhalin).

1822. *Chersea vulgaris* FLEMING, Philos. Zool., II, p. 295.—*Berus vulgaris* SWAINSON, Classif. Fish. Amph. Rept., II, (Lardner's Cab. Encycl.), p. 362.

The numerous synonyms based upon European color varieties are here omitted.

No distinctions have been pointed out between east Asiatic and European specimens, and no tangible ones seem to exist. It is perhaps worth noticing that the number of ventrals of all the eastern specimens recorded is rather high, viz, between 143 and 158, averaging about 150, while in a large number of western specimens (167) the average is about 145. This tendency toward a lower number of ventrals in the west is shown by a still lower average of 143 ventrals in 54 British specimens or even 137.5 in 11 specimens from the Pyrenean peninsula.



FIGS. 358-360.—COLUBER BERUS. 1⅓ × NAT. SIZE. 358, TOP OF HEAD; 359, SIDE OF HEAD; 360, UNDERSIDE OF HEAD. NO. 14325, U.S.N.M.

Description.—Adult female; U.S.N.M. No. 14325; Dui, island of Sakhalin (figs. 358–360). Rostral slightly higher than wide, well visible from above; snout above covered by about 16 scales, the fragments of internasals and prefrontals, of which two join the rostral and two larger ones cover the canthus rostralis between naso-rostral and supraocular; frontal as long as its distance from tip of snout, wider than supraoculars, from which it is separated by a series of scales; parietals irregularly broken up, the two large shields adjoining the frontal somewhat smaller than the latter; nostril large, in the middle of the posterior nasal, the anterior nasal, or prenasal, not entering nostril and therefore also known as naso-rostral; three loreals behind posterior nasal, one above, two below; eye on sides and below surrounded by nine scales, ten on right side; temporals numerous scales, more or less irregular, those of the anterior row not larger than the postoculars; nine supralabials, fourth and fifth largest, situated under the eye and separated by a single row of scales; four lower labials in contact with anterior chin-shields which are much larger than the posterior; 21 rows of scales, all except outer row keeled and with two apical pits; 146 ventrals; anal entire; subcaudals in pairs, 22+ (tail defective). Color (in alcohol) above tawny-olive with a brownish black, very distinct zigzag band along the middle of back and tail, and a series of obscure, alternating, lateral spots; top of head brownish black continuous with a similarly colored chevron mark opening backward on occiput; a brownish black band from nostril through eye over lower temporals to the side of neck passing over the last supralabial at angle of mouth; canthus rostralis and supralabials yellowish, the latter mostly with a black line along the posterior suture; chin and throat yellowish, mottled with dark slate color; whole underside uniform slate black, each ventral narrowly edged with pale olive.

Dimensions.

	mm.
Total length (tail defective)	568
Snout to vent	520

The proportion of tail to total length in the female averages as 1 to 9.33.

In the *male* the tail is considerably longer, with more numerous subcaudals, the proportion to total length averaging as 1 to 7.33.

The viper very rarely exceeds 700 mm. in total length.

Variation.—The specimen described above represents the average of this species, but both scutellation and coloration are very variable. The degree of breaking up of the normal shields of the head is thus very different in different individuals, so that two specimens exactly alike can rarely be found; thus the frontal may be in contact with the supraoculars, or on the other hand it may be separated from the parietals by a series of scales; number of scales around the eye varies between 6 and 13, of supralabials between 6 and 10. The variation in number of ventrals and its correlation with the geographical distribution has been alluded to above (p. 446).

The coloration is also exceedingly variable, at least in European specimens, the ground color varying through all the shades of brown and olive from silvery gray to black, and the pattern showing endless modifications of the one described above which may be said to be typical.

Habitat.—The common viper extends from western Europe to the Japanese and Okhotsk seas in the East.

Numerous specimens were collected in the island of Sakhalin by Prof. F. Schmidt, in 1863. Nikolski says that this snake is very common on the island, that Dobrotvorski noted it in the southern part and that Poljakof collected a specimen in the neighborhood of Korsakovski.

Maack obtained it in Ussuri, and von Schrenck in various parts of Amurland. Dybowski sent to the museum in Warsaw, Poland, a specimen taken at Possiet Bay near the boundary between Korea and the Russian Coast Province, according to Strauch, who also mentions its occurrence at Udskoi Ostrog.

The United States National Museum has one specimen from Sakhalin obtained from the St. Petersburg Academy. The museum in Hamburg has three specimens collected by Dieckmann at Nikolayevsk (No. 2162).

List of specimens of Coluber berus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Supralabials.
U.S.N.M.	14325	Female[a]	Dui, Sakhalin Island		St. Petersburg Academy.	21	146	1	....	9-10	9
Brit. Mus.	*a*[6]	do.[b]	Sakhalin Island		do	21	158	1	33	....	....
Do	*b*[6]	do.[b]	do		do	21	143	1	32	....	....
St. Petersburg.	1031	([c])	Dui, Sakhalin		F. Schmidt	21	152	....	32	....	....
Do	1032		do		do	21	149	....	39	....	....
Do	1028		Ussuri		Maack	21	153	....	33	....	....
Do	1029		Bay Hadshi, Amurl.		L. v. Schrenck	21	158	....	30	....	....
Do	1030		Uisut Island, Liman		do	21	151	....	32	....	....
Do	1035		Nikolayevsk		do	21	146	....	38	....	....

[a] Description p. 446; figs. 358-360. [b] Boulenger, Cat., III, p. 481. [c] Strauch, p. 279.

Family CROTALIDÆ.

The "pit vipers" receive their name from the deep pit or hole on the side of the face between the nostril and the eye, as shown in fig. 363. This cavity sinks deep into the maxillary bone and represents a "blind" sac lined with epidermis and not connected with any of the other cavities or organs in the head by any inside opening or canal.

The maxillary bone, into the lower end of which the large hollow fang is immovably fastened like the knife in a handle, is extremely shortened and higher than long so as to appear to be in a vertical position (fig. 361). On the outer face of this bone there is the deep cavity forming the bony walls of the pit already referred to, which separates two articular surfaces. The upper one at the top of the maxillary forms with the corresponding concave face of the lachrymal (prefrontal) bone, which projects from and articulates with the frontal bone, a hinge-like joint allowing considerable freedom of motion. The lower articular surface receives the flattened anterior end of the external pterygoid bone (ectopterygoid or transpalatine). It will be seen from the accompanying cut (fig. 361) that if the latter bone (*a*) be moved forward or backward, the maxillary (*d*) hinges on the lachrymal (prefrontal) (*e*) and that if the ectopterygoid be pushed forward the fang is erected.

For a more detailed description of the poison apparatus, the poison, etc., see my Poisonous Snakes of North America.[a]

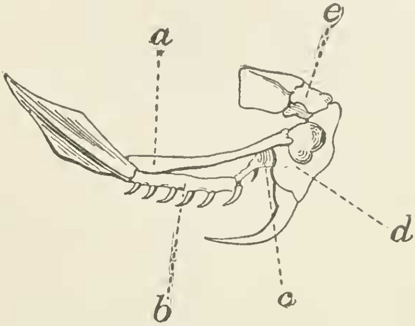


Fig. 361.—Poison apparatus of a Crotalid snake. Right side. *a*, External pterygoid bone (ectopterygoid or transpalatine); *b*, internal pterygoid bone (entopterygoid); *c*, palatal bone; *d*, maxillary bone; *e*, lachrymal bone (prefrontal). (After Mitchell.)

The Crotalid snakes are found in both hemispheres. They are entirely absent, however, in Africa and the southwestern corner of Asia, as well as in Australia. They are practically unknown in Europe also, except that one species enters the extreme southeastern corner.

The general impression that the *Crotalidæ* are overwhelmingly American in their distribution is entirely erroneous, as nearly 40 per cent of the known species occur in Asia, and I am strongly of the opinion that the family originated in the Old World and spread to America afterward. The rattlesnakes which are peculiar to the latter continent are the latest specialization of the type.

KEY TO JAPANESE GENERA OF CROTALIDÆ.

*a*¹ Top of head with large symmetrical shields .... *Agkistrodon*, p. 449.
*a*² Top of head covered with scales .... *Trimeresurus*, p. 465.

Genus AGKISTRODON[b] Beauvois.

1799. *Agkistrodon* Beauvois, Trans. Amer. Philos. Soc., IV, p. 381 (type, *A. mokasen*).
1802. *Scytale* Latreille, Hist. Nat. Rept., III, p. 158 (same type).
1803. *Cenchris* Daudin, Bull. Soc. Philom. (Paris), III, No. 72, March 1803, p. 188 (same type).
1819. *Scytalus* Rafinesque, Am. Journ. Sci., I, p. 84 (emendation).
1826. *Tisiphone* Fitzinger, Neue Class. Rept., pp. 34, 63 (type, *T. cuprea*).
1826. *Trigonocephalus* Boie, Isis, 1826, p. 214 (not of Oppel, 1811).
1836. *Acontias* Troost, Ann. Lyc. Nat. Hist. N. Y., III, p. 190 (type, *A. leucostoma;* not of Cuvier, 1829).
1836. *Toxicophis* Troost, Ann. Lyc. Nat. Hist. N. Y., III, p. 190 (same type).
1849. *Halys* Gray, Cat. Snakes Brit. Mus., p. 14 (type, *Trigonocephalus halys* Boie; not of Fabricius, 1803).
1854. *Ancistrodon* Baird, Serp. N. Y., p. 13 (emendation) (not of Roemer, 1849).

Among the species of the genus *Agkistrodon* which extends from the northern borders of the Caspian Sea throughout most of the Asiatic mainland and in North and Central America there is a small compact group consisting of the species *A. halys*, *blomhoffii* and *himalayanus* occupying the vast territory from the Caspian Sea in the west to the Pacific Ocean in the east, and from Lake Baikal in the north to the Himalayas in the south. They are closely interrelated, in fact so nearly allied that their descent from a common ancestor can not have taken place at a very distant period. Of these, *A. blomhoffii*, which is the only species occurring within our limits, shows certain differentiations according to locality, making it advisable to discriminate between several forms.

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[a] Rept. U. S. Nat. Mus. for 1893, pp. 365–380 and 457–480.

[b] From ἄγκιστρον, hook; ὀδών, tooth. The correct transliteration would be *Ancistrodon*.

The *Agkistrodon intermedius* which Strauch described in 1868 and characterized as an *A. blomhoffii* with 23 scale rows, Boulenger, on the other hand, diagnoses as an *A. halys* without the snout turned up. Practically both seem to be right, for as far as I can see *A. intermedius*, as accepted by them, is not a well-defined form (much less a species as this term is used conventionally), but an aggregation of more or less intermediate specimens. In the sense in which they have been adopted hitherto neither have a definable range. According to Strauch not only does *A. blomhoffii* occur in the same localities on the mainland as *A. intermedius*, but the latter occurs also in Japan promiscuously with the former, as individuals with 23 scale rows occur both in southern and northern Japan. The trouble is that the number of scale rows is not constant, the inconstancy apparently varying to some extent with the locality. On the other hand, to what extent the turning up of the end of the snout may serve in all instances as a character to separate *A. halys* I can not say for lack of material, and for that reason I shall at present treat the latter as a good species.

For the study of *A. intermedius* and *A. blomhoffii* I have collected about 100 more or less complete scale formulas of individual specimens, all of which will be found in the appended tables.

Table I*a* is a record of 27 specimens of undoubted Japanese origin.[a] They show *A. blomhoffii* in its purity with a normal scale formula of 21 scale rows; 132–146 ventrals (average 141.3); 44–56 pairs of subcaudals (average 49.2); and 7 supralabials. Two of the specimens in the United States National Museum, viz, Nos. 31866 and 34040, have 23 scale rows, and Strauch mentions that in the Leiden Museum he found some specimens from Japan also with 23 scale rows, while Hilgendorf records one of his Tokyo specimens as having 23 rows. On the other hand, the number of supralabials (7) seems to be absolutely constant in Japan.

Table II contains formulas of 20 specimens from Korea, southeastern China, and Formosa, viz, 21–23 scale rows; 138–151 ventrals

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[a] For reasons given farther on (p. 452), I have not included in this table certain specimens in the St. Petersburg Academy Museum, recorded by Strauch as being from Japan.

(average 143.8); 29–46 subcaudals (average 35). The supralabials are not given in detail, but judging from Boulenger's account all the specimens examined by him had 7. One of my Korean specimens has 8 supralabials on one side. It will be seen that these formulas agree tolerably with those from Japan *except* that the subcaudals are much fewer.

Tables III and IV embrace the specimens recorded from the region lying to the north and northwest of those contained in Table II—i. e., from the Russian Coast Province and the River Amur to eastern Turkestan. They represent mostly the specimens attributed to *A. intermedius* by Strauch and Boulenger. They agree in having an intermediate number of subcaudals, viz, 36–49 (average 41) and [32] 37–53 (average 43.7), respectively. They also agree fairly well in the number of ventrals, viz, 151–163 (average 155.8) and [147] 154–179 (average 163.5), respectively, but it will be seen that these figures greatly exceed the corresponding ones of Tables I and II. There is, however, one marked difference between Tables III and IV, since it will be found that among the specimens collected east of the Khingan Mountains in Manchuria (Table III) the great majority (70.6 per cent in a total of 17 specimens) have 21 scale rows, while of those from the Khingan Mountains and the country to the west, viz, Mongolia, Transbaikalia, and eastern Turkestan, the greater number (76 per cent, in a total of 29 specimens) have 23 rows or more.

Before proceeding farther a few words may be said regarding Table I*b*. The two specimens from Yaeyama in the United States National Museum agree structurally and in their scale formulas exactly with the Japanese specimens, but they differ exceedingly from the latter in color. Their ground color (in alcohol) is a "tawny olive,"[a] uniform on top of head, but indistinctly varied and marbled on back and sides with blackish and with indications of pale cross bands; a band slightly darker than the ground color through eye and temples; lips whitish, as is also the whole underside; each ventral sprinkled with irregular blackish brown dots and spots on the basal half. It seems probable that they represent a permanent local color race, and are so recognized further on.

The differences between the specimens listed in Tables I–IV may be synoptically expressed as follows:

*a*¹ Ventrals 151 or less.
  *b*¹ Subcaudals 43 or more..........Tables I and I*a* (Japan and Yaeyama Islands).
  *b*² Subcaudals 46 or less...........Table II (SE. China; Korea; Formosa).
*a*² Ventrals 147 or more.
  *b*¹ Scale rows (in 70.6 per cent) 21..Table III (Coast Province; Amurland, west to Khingan Mountains).
  *b*² Scale rows (in 79 per cent) 23....Table IV (Khingan Mountains to East Turkestan).

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[a] Ridgway, Nomencl. Colors, 1886, pl. III, No. 17.

It will be seen that a considerable amount of intergradation occurs. Thus it would be impossible to say to which of the three forms (Tables II, III, or IV) a specimen with 151 ventrals and 45 subcaudals were to be referred, unless it had 8 supralabials, in which case it would probably be correct to refer it to either Tables III or IV, with the chances in favor of Table III, if it had 21 scale rows, and in favor of Table IV if it had 23 rows. Unfortunately, the number of supralabials is not given in detail in the recorded scale formulas, or we might perhaps have been able to make a more definite statement. We only know in a general way that quite a large number of the specimens included in Tables III and IV have 8 supralabials, and I hold it to be probable that there are more having 8 supralabials in Table IV than in Table III.

I now call attention to Table V, containing the records of five specimens in the Zoological Museum of the St. Petersburg Academy of Sciences, which are reported to be from Japan. These, with a number of other snakes, were sent to the academy in 1861 by Mr. Goschkewitsch, who was Russian consul at Hakodate, Japan; hence Strauch concluded that they were from Yezo. Of the five Agkistrodons, he referred No. 2225, with 23 scale rows, to *A. intermedius;* the other four, with only 21 scale rows, to *A. blomhoffii*, the typical Japanese species. Upon this evidence rests the admittance of *A. intermedius* into the fauna of Japan proper. A glance at Table V shows at once, however, that the five specimens did not come from the island empire at all. They belong most assuredly to Table III, within the limits of which not only the extremes are easily accommodated but with the averages of which their own averages nearly coincide (ventrals, respectively, 156.4 and 155.8; subcaudals 42 and 41). If we consider, furthermore, that Mr. Goschkewitsch sent two other species, which nobody else has found in Japan (namely, *Elaphe dione*, see p. 318, and *E. schrenckii*, see p. 315), but which occur in the Amur Province, I think there can not be a shadow of a doubt that all the specimens sent by him were only shipped from Japan but collected somewhere on the mainland, either in the Coast Province or in Amurland.

Table Ia.—*Japan.*

Museum.	No.	Sex and age.	Locality.	Authority.	Scale rows.	Ventrals.	Subcaudals.	Supralabials.
U. S. N. M.	15421	Female	Omachi, Hondo	Stejneger	21	139	53	7
Do	15422	Young	do	do	21	142	48	7
Do	15423	do	do	do	21	132	47	7
Do	15424	do	do	do	21	144	49	7
Do	15425	do	do	do	21	139	53	7
Do	15426	do	do	do	21	141	54	7
Do	17847		Japan	do	21	....	....	7
Do	23436	Halfgr.	Yezo	do	21	143	52	7
Do	31866	Female	Shikoku	do	23	140	47	7
Do	31867	Male	do	do	21	142	45	7
Do	34023	Female	Yokohama	do	21	140	49	7
Do	34024	Male	do	do	21	144	56	7
Do	34040	Female	do	do	23	137	45	7
Do	34041	Male	do	do	21	144	55	7
Do	34042	do	do	do	21	146	49	7
Do	34043	Female	do	do	21	143	47	7
	......	(a)	Japan	Boie	21	142	45	....
Sci. Coll. Tokyo	59	Female	Hachijo shima	Stejneger	21	139	46	7
St. Petersb	2231		Japan	Strauch	21	140	46	....
Leiden			do	Schlegel	....	136	46	....
Do			do	do	....	142	56	....
Brit. Mus	*a*	Male	do	Boulenger	21	140	48	7
Do	*b*	Female	Yokohama	do	21	145	47	7
Do	*c*	Male	do	do	21	142	55	7
Do	*e*	do	Tsu-shima	do	21	146	46	7
Do	*f*	Halfgr.	do	do	21	138	44	7
Do	*g*	Young	do	do	21	145	45	7
			Average		....	141.3	49.2	....

[a] Type of *blomhoffii.*

Table Ib.—*Yaeyama Islands.*

U.S.N.M	34038		Yayeyama	Stejneger	21	139	49	7
Do	34039		do	do	21	138	53	7
Brit. Mus	*x*	Male[a]	(?)	Boulenger	21	137	46	7
			Average		....	138.0	49.3	....

[a] Type of *affinis.*

TABLE II.—(*East China; Korea; Formosa.*)

Museum.	No.	Sex and age.	Locality.	Authority.	Scale rows.	Ventrals.	Subcaudals.	Supralabials.
U.S.N.M	14612	....	Korea	Stejneger	21	142	34	7-8
Do	14613	....	do	do	21	146	37	7
Do	17507	Male[a]	Fusan, Korea	do	21	148	31	7
Do	17508	do	Seoul, Korea	do	21	146	34	7
Mich. Univ	1	Young	Korea	do	21	150	42	7
Brit. Mus	*o*	Male	Hang-Chau, China	Boulenger	21	144	41	7
Do	*p*	do	Ichang, China	do	21	144	35	7
Do	*q*	Female	do	do	21	140	30	7
Do	*r*	Male	do	do	21	143	38	7
Do	*s*	Female	Mountains north of Kiukiang, China.	do	23	145	31	7
Do	*t*	do	do	do	21	142	32	7
Do	*u*	do	do	do	21	138	29	7
Do	*v*	Young	do	do	21	138	32	....
Do	*w*	Female	do	do	21	143	31	7
Do	*h*	Male	Formosa	do	23	151	40	7
Do	*i*	do	do	do	21	146	46	7
Do	*k*	Female	Hainan	do	21	142	.....	7
Do	*l*	do	do	do	21	144	32	7
Do	*m*	Young	do	do	21	144	39	7
Do	*n*	do	do	do	21	141	32	7
			Average		....	143.8	35.0	....

[a] Type of *brevicaudus*.

TABLE III.—*Coast Province; Amurland, west to Khingan Mountains.*

St. Petersb	2219	....	Ussuri	Strauch	23	163	36	....
Do	2221	....	Cape Tyr	do	23	161	......	....
Do	2232	....	Possiet Bay	do	21	156	40	....
Do	2233	....	Upper Amur	do	21	153	41	....
Do	2234	....	Komar	do	21	154	37	....
Do	2236	....	Amur	do	21	151	47	....
Do	2237	....	Ana, Ussuri	do	21	157	44	....
Do	2238	....	Amur	do	21	151	49	....
Do	2240	....	Bay Guerin	do	21	153	41	....
Do	2241	....	Adi, Amur	do	21	154	41	....
Do	2242	....	Noor, Ussuri	do	21	158	41	....
Do	3723	....	Tschianka, Amur	do	21	155	36	....
Do	3723	....	Ussuri	do	21	158	42	....
Do	3724	....	do	do	21	155	43	....
Brit. Mus	*c*	Male	Khabarovka	Boulenger	23?	155	40	....
Do	*d*	do	do	do	23?	156	40	....
Do	*e*	Female	Ussuri River	do	23?	158	39	....
			Average		....	155.8	41.0	....

TABLE IV.—*Khingan Mountains to East Turkestan.*

Museum.	No.	Sex and age.	Locality.	Authority.	Scale rows.	Ventrals.	Subcaudals.	Supralabials.
St. Petersb	2216		Padun	Strauch	23	162	45	....
Do	2217		do	do	23	164	39	....
Do	2218		Nikolski Zavod	do	23	161	43	....
Do	2222		Khingan	do	23	157	42	....
Do	2223		Daurian Steppes	do	23	163	32	....
Do	2224		Tarei Noor	do	23	167	41	....
Do	2226		Argun River	do	25	160	43	....
Do	3719		Bukukun	do	23	163	40	....
Do	3720		Khingan	do	23	161	37	....
Do	2235		Argun	do	21	160	42	....
Do	2239		Ust Strielka	do	21	154	46	....
Do	2243		Gobi	do	21	147	51	....
Do	3721		Khingan	do	21	155	49	....
Do			Ordos	do	23	179	44	7-8
Do			do	do	23	169	42	8
Do			Ala-shan Governm	do	21	163	48	8
Do			do	do	21	168	37	7
Stockholm	1806	Female	Altai	Stejneger	25	172	43	8
Do	1807	Male	do	do	21	175	51	7-8
Do	1808	Female	do	do	23	163	47	8
Do	1809	do	do	do	23	171	46	7-8
Do	1810	Male	do	do	23	161	53	8
Do	1811	do	do	do	23	166	47	7
Do			Southern Mongolia	Méheli	23	163	37	....
Do			do	do	23	170	43	....
Brit. Mus	*a*	Halfgr	East Turkestan	Boulenger	23?	161	49	....
Do	*b*	Female	Smeinogorsk	do	23?	166	45	....
Do	*f*	Halfgr	Lob Nor	do	23?	157	42	...
Do	*g*	do	do	do	23?	164	44	....
			Average		....	163.5	43.7	....

TABLE V.—"*Japan*" *Goschkewitsch, 1861.*

Museum.	No.	Sex and age.	Locality.	Authority.	Scale rows.	Ventrals.	Subcaudals.	Supralabials.
St. Petersb	2225		"Japan" (?)	Strauch	23	162	38	....
Do	2227		do	do	21	153	42	....
Do	2228		do	do	21	157	42	....
Do	2229		do	do	21	157	41	....
Do	2230		do	do	21	153	47	....
			Average		....	156.4	42.0	....

It may now be regarded as demonstrated that the only form found in the islands of Japan proper is *Agkistrodon blomhoffii* which, so far as the accessible material and records go, is the best differentiated form.

The Korean and Chinese forms differ only in the fewer subcaudals. There is no absolutely sharp line between the two forms inasmuch as 44 is the minimum of the former and 46[a] the maximum of the latter. Yet, of the 36 specimens enumerated, only one (Brit. Mus. No. *h*), or less than 3 per cent would be unidentifiable by that test. The averages 49 and 35.3 are much more significant, and it is scarcely to be doubted that we have to do with a form which it will be advantageous to recognize by name.

Contiguous to this South Chinese and Korean form we have another occupying the mainland to the north and northwest. Its chief characteristic consists in the greater number of ventrals, which in 36 specimens vary between [147] 151–170 (average 158.4). In addition numerous specimens have eight supralabials and about one-half 23 scale rows instead of 21. With regard to the latter character it is possible to divide the localities of these specimens into two classes, the great majority of them occupying the territory east of the Khingan Mountains having 21 scales, those farther west 23. The percentage of exceptions in each group, namely, respectively 29 and 24 per cent—is too great to make it advantageous to recognize two forms. Unfortunately, the published records do not indicate whether the number of supralabials is more constant. For the present at least they must be united under the name of *A. blomhoffii intermedius*, a term consequently somewhat more comprehensive than Strauch's original *A. intermedius*.

We have thus three, or possibly four, local forms which may be recognized by the following key:

- a^1. Ventrals 151, or less.
  - b^1. Subcaudals 44, or more.
    - c^1. Underside black, more or less blotched with whitish....*A. blomhoffii*, p. 457.
    - c^2. Underside whitish, sprinkled with blackish ....*A. blomhoffii ? affinis*, p. 461.
  - b^2. Subcaudals 46, or less......................*A. blomhoffii brevicaudus*, p. 463.
- a^2. Ventrals (147) 151, or more......................*A. blomhoffii intermedius*, p. 464.

The most interesting conclusion to be drawn from the above is that the typical Japanese form is least closely related to the northern *A. intermedius*, which occurs on the opposite side of the Sea of Japan, and that their connection is only effected through the shorttailed southern Chinese form, a conception entirely different from the one formerly held, according to which there were two distinct species, both occurring on either side of the Sea of Japan. The latter would involve a previous northern line of intercommunication between the two territories, while now it is seen that the connection between these forms lies toward the south.

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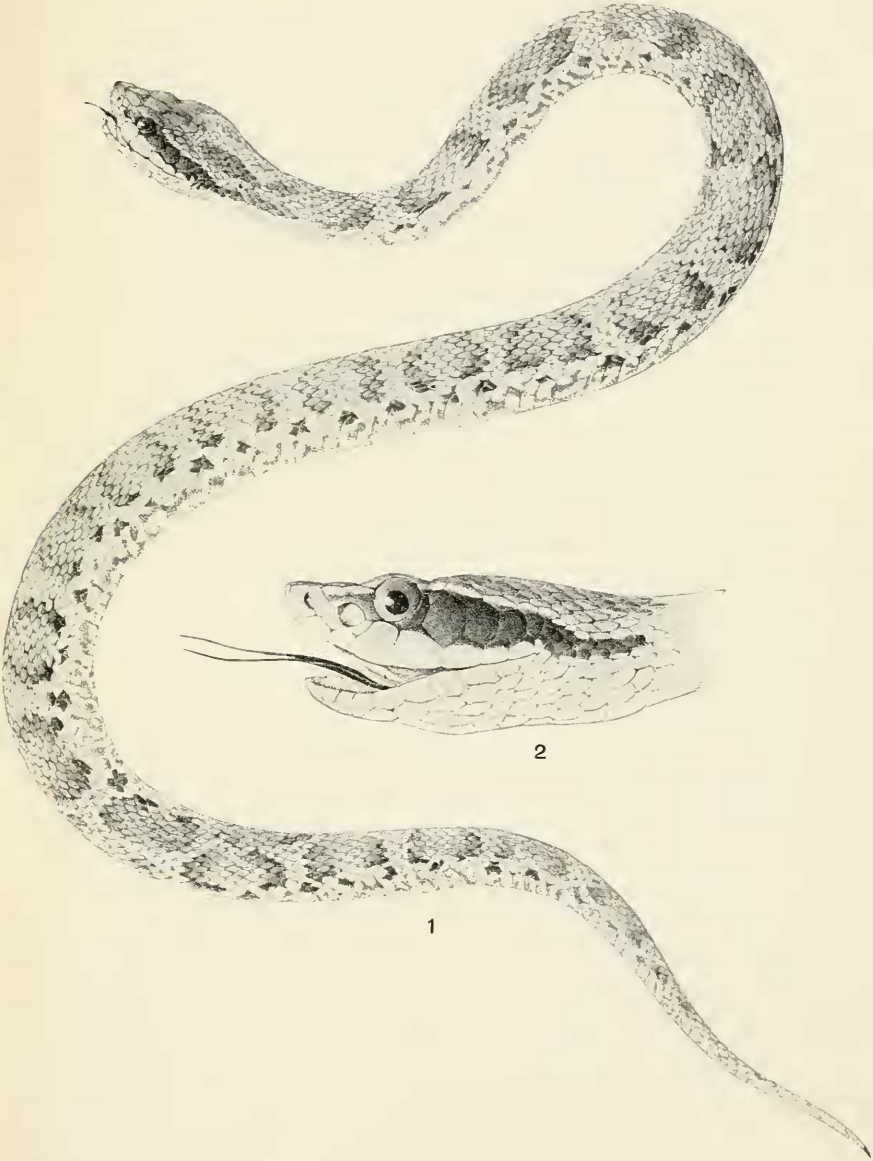
[a] It would appear that the number may exceptionally reach 50, which is the maximum noted by Doctor Werner for some specimens from Hankow. I will here again call attention to the fact that possibly some of Doctor Haberer's specimens alleged to have been collected at Hankow in reality may be from Japan, where he also collected. (See under *Elaphe climacophora*, p. 326; *quadrivirgata*, p. 331; and *conspicillata*, p. 336.)



AGKISTRODON BLOMHOFFII. (FROM TEMMINCK AND SCHLEGEL.)

FOR EXPLANATION OF PLATE SEE PAGE 555.

AGKISTRODON BLOMHOFFII[a] (Boie).

MAMUSHI.

Plate XXVI.

1826. *Trigonocephalus blomhoffii* BOIE, Isis, 1826, p. 214 (type-locality, Japan; Blomhoff, collector); Bijdr. Natuurk. Wetensch., II, Pt. 1, 1827, p. 268.—TEMMINCK and SCHLEGEL, Fauna Jap., Rept., 1837, pp. 88, 96, 139; Ophid., pl. VI[b] (Kiusiu; Hondo).—DUMÉRIL and BIBRON, Erpét. Gén., VII, Pt. 2, 1854, p. 1496 (Japan).—BLEEKER, Natuurk. Tijdschr. Nederland. Indië, XVI, 1858, p. 204 (Japan).—STRAUCH, Mém. Acad. Sci. St. Pétersb. (7), XXI, No. 4, 1873, pp. 251, 282 (part: spm. No. 2231: Japan, Maximowitch, collector).—HILGENDORF, Mitth. Deutsch. Ges. Ost-Asiens, I, heft 10, July 1876, p. 30 (Tokyo).—EASTLAKE, Trans. Asiat. Soc. Japan, XIII, 1885, p. 72 (Japan); Nature, XXXI, April, 1885, p. 587.—OKADA, Cat. Vert. Japan, 1891, p. 69 (Kaga; Kyoto; Tokyo; Awa, Hondo; Hachijo shima; Echigo; Awaji; Yezo; Toza).—*Halys blomhoffii* GUENTHER, Rept. Brit. India, 1864, p. 393 (part: Japan).—HILGENDORF, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 117 (Tokyo).—*Ancistrodon blomhoffii* BOULENGER, Cat. Snakes Brit. Mus., III, 1896, p. 525 (part: Yokohama; Tsushima).—WALL Proc. Zool. Soc. London, 1903, p. 102 (part: Japan); 1905, II, p. 514 (Hondo; Yezo; Tanega I.; Yaku I.).

1837. *Trigonocephalus blomhoffi* SCHLEGEL, Phys. Serp., II, p. 552 (Japan).—FRITZE, Mitth. Deutsch. Ges. Ost-Asiens, V, heft 46, 1891, p. 238 (Yezo).—*Ancistrodon blomhoffi* BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 137 (Hondo; Yezo).—SCHNEE, Zool. Garten, XLI, 1900, p. 395 (color description from life).

1859. *Trigonocephalus blomhoffii* var. *megaspilus* COPE, Proc. Phila. Acad., 1859, p. 336 (type-locality, unknown; type in Phila. Acad. Mus.; collected by the Perry Expedition).

1862. *Halys bloomhoffii* PETERS, Mon. Ber. Berlin Akad. Wiss., 1862, p. 671 (*lapsus*).

Description.—Adult male; U.S.N.M. No. 31867; Kochi, province of Toza, Shikoku, May, 1903; Dr. Hugh M. Smith, collector (figs. 362–364). Rostral as high as broad scarcely visible from above; internasals small, subtriangular, their suture half that between prefrontals which are broadly in contact with supraoculars; frontal slightly longer than broad, as long as its distance from rostral and as interparietal suture, nearly straight in front; supraoculars longer than frontal and nearly as broad at the center of eye; parietals as long as supraoculars, longer than distance of frontal from tip of snout; nostril roundish in the posterior edge of the anterior nasal which is twice as large as the posterior; two loreals one above the other, the lower one bordering the pit anteriorly; a narrow subfoveal bordering the pit below posteriorly, not reaching the eye; two preoculars, of which the lower borders the pits above posteriorly; pit nearer eye than nostril; two postoculars, of which the lower is long, narrow, and crescentic, nearly reaching the lower preocular below the eye and separating the latter from fourth supralabial; 2+4 temporals, of which the lower ones in each row are large hexagonal flat shields, those above being small scales, keeled on the row nearest the parietals: the lower temporal of the third row large and shaped like those in front of it; these three lower temporals form a series of large shields larger than the adjoining labials; 7 supralabials, second smallest, third and fourth largest, and those behind gradually decreasing in size, third just entering eye; five lower labials in contact with anterior chin-shields, which are much larger than the second pair, the latter being scarcely differentiated from the scales behind and between them; 21 rows of strongly keeled scales with a pair of apical pits; 142 ventrals; anal undivided; 45 subcaudals, all divided. Color (in alcohol) above brownish gray with a series of large, rhomboid, darker brown, black-edged blotches on each side close to the median dorsal line, alternating, often confluent, descending on the sides to the outer scale row, separated by a narrow paler grayish band the edges of which nearest the black margin of the dark blotches incline to whitish; top of head of lighter brown, with a dark irregular marking on each shield; a sharply marked blackish brown stripe on lower preocular through eye where it widens to a very broad band on the temples, passing across the last supralabial at the corner of the mouth, the sharp edges of this band emphasized by a narrow white line above and below, the one below having a small sharply defined white spot on the anterior angle of the long crescentic lower postocular; underside irregularly mottled with whitish and blackish in about equal proportions; tip of tail brownish white.

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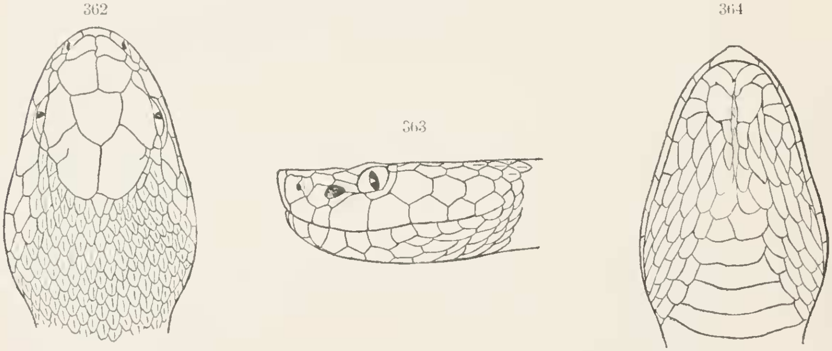
[a] Blomhoff was director of the Dutch factory on Decima for more than ten years during the early part of the nineteenth century. His collections were brought to Batavia, where H. Boie described the reptiles and batrachians.

[b] Reproduced in this work on Plate XXVI.



Figs. 362-364.—Agkistrodon blomhoffii. 1⅓ × nat. size. 362, top of head; 363, side of head; 364, underside of head. No. 31867, U.S.N.M.

Dimensions.

	mm.
Total length	513
Snout to vent	438
Vent to tip of tail	75

The *young* have clearer, brighter colors, more contrasting pattern, and the tail always light colored toward the tip both above and below.

Variation.—The most obvious instability in the scale formula is the varying number of temporals, but this variability is only confined to the upper scales near the parietals. As a matter of fact the outer edges of the later shields seem to be on the verge of breaking up into small scales as evidenced by the many nicks and half-finished sutures on their outer margins. The prefrontals also show sign of breaking up, and there is a distinct regularity in this process. In nearly all the specimens the inner anterior corner of these shields is more or less convex, and in a number of cases this slightly elevated region is cut off by regular sutures so as to form an additional anterior pair of prefrontals adjoining the internasals. Such is the adult female, No. 34043, from Yokohama. Quite similar in this respect is the adult female No. 15421, from Omachi, province of Shinshiu, and what is even more interesting, no less than three of her five young just born have these accessory prefrontals exactly like the mother, while only two of them are normal.

The number of supralabials, 7, is remarkably constant. Less so is the number of scale-rows, namely, 21, but 23 is rather of rare occurrence. The ventrals range between 132 and 146; subcaudals between 44 and 56 pairs.

The coloration is very variable. While specimens lighter than the one described above do occur, individuals much darker seem to be more frequent, and it is not uncommon to find specimens with the whole underside uniformly black or nearly so. While the tip of the tail seems to be always light yellowish in the young I find among the adults before me an even proportion of specimens with dark and light tail ends, there being apparently no distinction as to sex or locality.

The specimen from Hachijo shima (U.S.N.M. No. 36540), the southernmost island of the Idzu group, kindly submitted to me by Doctor Ijima, differs greatly in coloration from the normal specimens. The ground color is of a rich reddish brown with nearly all traces of blackish gone. In all other respects the specimen seems to be normal. Doctor Ijima writes me that he has six more specimens from the same locality of a similar coloration, but adds that the Science College Museum also has a specimen (No. 58) from the same island of a dark color similar to those from Hondo. In view of this fact I refrain from imposing any systematic name on this color variety.

Habitat.—As here understood *A. blomhoffii* is restricted to the islands of Japan, being represented on the mainland opposite by closely allied forms, in Korea by *A. blomhoffii brevicaudus*, in the Russian Coast Province by *A. blomhoffii intermedius*.

The mamushi occurs more or less frequently on the four principal islands. Eastlake says that it "is most frequent in the neighborhood of Kyoto, also the environs of Yokohama and the Hakone Mountains; tolerably frequent in the north." In Yezo it was observed by Doctor Fritze on the road to Kamigawa in the neighborhood of Sorachi-buto, and the United States National Museum, thanks to the kindness of Doctor Nozawa, has a specimen, which probably came from near Sapporo.

It seems to be common in the seven islands of Idzu, at least on Hachijo shima, from which island the Science College has six specimens, the majority of an unusual bright reddish color.

Doctor Wall records two specimens from the islands south of Kiusiu, namely, one from Yaku shima and one from Tanega shima, the former with 143, the latter with 142 ventrals, and both with 23 scale rows.

Holst collected specimens on Tsu-shima, which are now in British Museum.

List of specimens of Agkistrodon blomhoffii.

U. S. N. M. No.	Sex and age.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
15421	Female[a].	Omachi, Shinshiu	1882. Oct. —	P. L. Jouy	21	143	1	48	2,2	2+4	7
15422	Young[b]	do	do	do	21	142	1	48	2,2	2+3	7
15423	do.[b]	do	do	do	21	132	1	47	2,2	2+4	7
15424	do.[b]	do	do	do	21	144	1	49	2,2	3+4	7
15425	do.[c]	do	do	do	21	139	1	53	2,2	2+4	7
15426	do.[c]	do	do	do	21	141	1	54	2,2	3+4	7
17847		Japan		H. Loomis	21						7
23436	Half gr.	Yezo		S. Nozawa	21	143	1	52	2,2	2+3-4	7
31866	Female	Kochi, Shikoku	1903. May —	Dr. H. M. Smith	21	140	1	47	2,2	2+4	7
31867	Male.[d]	do	do	do	21	142	1	45	2,2	2+4	7
34023	Female	Yokohama	1902. June 20	A. Owston	21	140	1	49	2,2	2+3	7
34024	Male	do	do	do	21	144	1	56	2,2	2+4	7
34040	Female	do	1894. Aug. —	do	23	137	1	45	2,2	2+3-4	7
34041	Male	do	1901. July 24	do	21	144	1	55	2,2	2+4	7
34042	do	do	1902. June 6	do	21	146	1	49	2,2	2+3	7
34043	Female[e].	do	1901. Aug. —	do	21	143	1	47	2,2	2—3+4	7
36540	do	Hachijo shima	1887. May	N. Okada	21	139	1	46	2,2	2+3	7

[a] 2 pairs of prefrontals.

[b] Young of 15421; 2 pairs of prefrontals.

[c] Young of 15421.

[d] Description, p. 457; figs. 362–364.

[e] 2 pairs of prefrontals.

AGKISTRODON BLOMHOFFII ?AFFINIS[a] (Gray).

1849. ? *Trigonocephalus affinis* GRAY, Cat. Sn. Brit. Mus., p. 14 (type-locality unknown; type in Brit. Mus.; Capt. Sir Edward Belcher, collector).

Allusion has already been made (p. 451) to two specimens from Yaeyama, in the United States National Museum, which in every respect except color agree with the specimens from Japan proper. As there stated their ground color (in alcohol) is a "tawny-olive," uniform on top of head, but indistinctly varied and marbled on back and sides with blackish, and with indications of pale cross bands; a band slightly darker than the ground color through eye and temples; lips whitish, as is also the whole underside, each ventral sprinkled with irregular blackish brown dots and spots on the basal half.

I venture to suggest that the type specimen of Gray's *Trigonocephalus affinis* in British Museum may belong to this form. At least his brief description seems to justify such a suggestion. The specimen has no locality attached to it, but it was presented to the museum by Capt. Sir Edward Belcher. As noted later under *Trimeresurus elegans* (p. 471,) Belcher surveyed and collected on Ishigaki shima, in the Yaeyama group for three weeks, and there is consequently a possibility that the type of *Trigonocephalus affinis* came from that island. Under these circumstances I adopt Gray's name provisionally and with the necessary reservation.

Finally I wish to call attention to specimen *d* in Boulenger's enumeration of the specimens of *A. blomhoffii* in the British Museum.[b] It is a female with 142 ventrals and 43 subcaudals, presented by Mr. M. K. Rokugo, and said to have been collected in "Okinawa, Loo Choo Islands." Nobody else has recorded the mamushi from the middle group or Okinawa shima proper, and it is therefore rather probable that the specimen in question came from some other locality, possibly from the southern group.

It is not in the least probable that the Yaeyama *Agkistrodon* is directly connected, in a genetic sense, with the typical *A. blomhoffii* in Japan. It seems much more likely that the former is a slight modification of the Formosan stock which has developed in the same direction as the Japanese form, viz, toward an increased number of subcaudals, assuming at the same time a peculiar pale coloration. As a slight indication of their relationship with the mainland form rather than with the one from Japan, I may mention the absence of the white spot on the anterior corner of the long lower postocular.

As previously intimated, the Yaeyama specimens are mainly distinguished from the typical *A. blomhoffii* by the coloration and a detailed description of the lepidosis is therefore unnecessary. I wish, however, to call attention to a peculiarity in their scutellation (fig. 365), which may or may not indicate a real difference. This feature consists in the consolidation of the two scales above the large lower temporals of the second and third rows into a single elongate shield which is in contact anteriorly with the large lower shield of the first row without extending above it; at the same time the two lower shields of the second and third rows are reduced in size and their upper edges form a straight line parallel with the edge of the lip. The arrangement does not appear abnormal and is absolutely identical in both specimens, though in No. 34039 it is only found on the right side, while on the left it is as in typical *A. blomhoffii.*

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[a] Signifying related.

[b] Cat. Sn. Brit. Mus., III, p. 526.

Color description.—Adult male; U.S.N.M., No. 34038; Yaeyama, Riu Kiu Archipelago; October 12, 1900; A. Owston collection. The predominating color (in alcohol) above is a pale drab, with very faint indications of slightly browner cross-bars with traces of darker gray edges, the cross-bars separated by narrow slightly paler interspaces; on the outer row of scales and the adjoining corner of the ventrals a series of irregular cinnamon-colored spots about 2–3 ventrals apart; head uniform, the temporal region darker, especially on the upper border of the adjoining supralabials on which the contrast with the pale color of the rest of these shields is fairly well contrasted; only faint traces of a whitish line above and below the dusky area on the temporal region; lower postocular uniform drab without anterior white spot; underside whitish with slight and irregular dark gray markings at the base and outer corner of the ventrals.

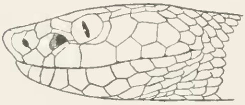

FIG. 365.—AGKISTRODON BLOMHOFFII ? AFFINIS. 1⅓ × NAT. SIZE. SIDE OF HEAD. NO. 34038, U.S.N.M.

Dimensions.

	mm.
Total length	404
Snout to vent	340
Vent to tip of tail	64

Variation.—No. 34039 differs chiefly in being still paler and more cinnamon-colored with even less traces of a pattern on the upper side and on sides of head; on the other hand, the dark gray markings on the underside are distinctly darker but not larger.

The difference in the scutellation of the temporal region on the two sides of this specimen has been alluded to above.

Habitat.—Uncertain as the whole status of this form is, the only statement which can be made with certainty refers to the two specimens in the U. S. National Museum, which were collected October 12, 1900, on Yaeyama, according to Mr. A. Owston.

Whether it occurs on any of the other islands it is impossible to say now, but it appears probable that it is confined to the southern group of the Riu Kiu Archipelago.

List of specimens of Agkistrodon blomhoffii ? affinis.

U.S. N.M. No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
			1900.								
34038	Male[a].	Yaeyama, Riu Kiu	Oct. 12	A. Owston	21	139	1	49	2,2	2 4	7
34039	do	do	do	do	21	138	1	53	2,2	2+3—4	7

[a] Description, p. 462; fig. 365.

AGKISTRODON BLOMHOFFII BREVICAUDUS[a], new subspecies.

1856. *Trigonocephalus blomhoffii* HALLOWELL, Proc. Phila. Acad., 1856, p. 153 (Ningpo, China) (not of Boie, 1826).—*Halys blomhoffii* GUENTHER, Rept. Brit. India, 1864, p. 393 (part: Formosa).—SWINHOE, Proc. Zool. Soc. London, 1870, p. 412 (Ichang, China).—GIGLIOLI and SALVADORI, Proc. Zool. Soc. London, 1887, p. 594 (part: Fusan, Korea).—*Ancistrodon blomhoffii* BOULENGER, Cat. Snakes Brit. Mus., III, 1896, p. 525 (part: Formosa; Hainan, Chekiang, Ichang, Mts. north of Kiukiang, China).—WALL, Proc. Zool. Soc. London, 1903, p. 98 (part: Shanghai; Yangtse Valley).—WERNER, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 357 (Ningpo Mts. and Hankow, China).—NIKOLSKI, Zap. Imp. Akad. Nauk, S. Peterburg, (8) XVII, no. 1, 1905, p. 329 (part: Korea).

1863. *Halys blomhoffii* SWINHOE, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 225 (Tamsui, Formosa).—BOETTGER, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 153 (part: China).

Diagnosis.—Similar to *Agkistrodon blomhoffii*, but number of subcaudals averages only 35 (known mimimum 29, known maximum 46); scale rows 21, rarely (about 10 per cent) 23; supralabials 7, very rarely (about 2½ per cent) 8; ventrals 138–151.

Dimensions of type specimen (adult male).

	mm.
Total length	595
Snout to vent	532
Vent to tip of tail	63

Type.—U.S.N.M. No. 17507; Fusan, Korea; 1885; P. L. Jouy, collector.

Remarks.—This form is so much like typical *Agkistrodon blomhoffii*, from Japan, that no detailed description is deemed necessary. Of the four adult Korean specimens before me, three have uniform black belly. If this series can be trusted the dark postorbital band descends slightly farther down on the supralabials than in Japanese specimens. All lack the white spot at the anterior angle of the crescentic lower postocular.

Habitat.—Eastern China, Korea, and Formosa.

Our knowledge of the distribution of this form is very defective. In China it has thus far been found in the eastern part, although apparently always some distance back from the coast; for instance, at Ningpo, Ichang, Chekiang, Kiukiang, etc. It seems probable that it is confined to the more mountainous districts without coming down on the alluvial plains. Four specimens said to be from Hoi How, island of Hainan, were presented by J. Neumann to the British Museum. This locality needs corroboration [a] (see pp. 326, 331 and 336). In Korea it has been collected both at Seoul and Fusan by the late P. L. Jouy.

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[a] Signifying short-tailed.

Two male specimens from Formosa collected by Swinhoe are in the British Museum.

List of specimens of Agkistrodon blomhoffii brevicaudus.

Museum.	No.	Sex and age.	Locality.	When collected	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
U.S.N.M.	14612	Male	Korea		N. M. Ferebee.	21	142	1	34	2, 2–3	2+4	7–8
Do	14613	Female	do		do	21	146	1	37	2, 2–3	2+3–4	7
Do	17507	Male [a]	Fusan, Korea	1885	P. L. Jouy	21	148	1	31	2, 2–3	2+4	7
Do	17508	do	Seoul, Korea	1883	do	21	146	1	34	2, 3	2+4	7
Mich. Univ.	30525	Young [b]	Korea		G. A. Olinger.	21	150	1	42	2, 3	2+4	7

[a] Type; p. 463.

[b] Total length, 335 mm.

AGKISTRODON BLOMHOFFII INTERMEDIUS[b] (Strauch).

1859. *Trigonocephalus blomhoffii* Maack, Putesh. na Amur (p. 152) (Amurland) (not of Boie); Putesh. na Ussuri, 1861 (p. 190) (valley of the Ussuri).—Strauch, Trudi Perv. Siezda Russkikh Yestestv., Zool., 1868 (p. 296); Mém. Acad. Sci. St. Pétersb. (7), XXI, no. 4, 1873, pp. 251, 282 (Ussuri and Amurland; Possiet Bay and Vladivostok; De Castries Bay); in Przevalski's Mongoliya i Strana Tangutov, III, 1876, p. 52 (Ala-shan Government).—Giglioli and Salvadori, Proc. Zool. Soc. London, 1887, p. 594 (part: Olga Bay, Russ. Coast Prov.).—*Ancistrodon blomhoffii* Boulenger, Ann. Mag. Nat. Hist. (6), V, Feb. 1890, p. 140 (Amurland; Ussuri).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg, (8) XVII, no. 1, 1905, p. 329 (Amurl.; Ussuri, etc.)

1868. *Trigonocephalus intermedius* Strauch, Trudi Perv. Siezda Russkikh Yestestv., Zool., (p. 294); Mém. Acad. Sci. St. Pétersb. (7), XXI, no. 4, 1873, pp. 245, 282 (type-locality, Governm. Irkutsk, East Siberia: types in St. Petersb. Acad.); in Przewalski's Mongoliya i Strana Tangutov, III, 1876, p. 52 (Ordos).—*Halys intermedia* Peters, Mon. Ber. Berlin Akad. Wiss., 1877, p. 735 (Smeinogorsk, Tomsk Governm.).—*Halys intermedius* Boettger, Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 153 (Nan-shan, near Kuku-nor, south. Gobi; Ala-shan Desert, Prov. Ordos; Russ. Turkestan; east. Siberia).—*Ancistrodon intermedius* Boulenger, Ann. Mag. Nat. Hist. (6), V, Feb. 1890, p. 140 (Kunges, east. Turkestan;

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[a] Bocourt (Nouv. Arch. Mus. Paris, II, 1866, Bull., p. 9), in a list of the reptiles brought home by him from the southern provinces of Siam, mentions "*Trigonocephalus blomhoffii.*" Locality and identification need corroboration.

[b] Signifying intermediate, i. e., in characters between *A. blomhoffii* and *A. halys.*

Smeinogorsk; Khabarovka, Ussuri); Cat. Sn. Brit. Mus., III, 1896, p. 525 (Tarim Riv, Lob Nor).—Méhely, Zichy's Dritte Asiat. Forschungsr., II, 1902, p. 58 (Southern Mongolia: Chalute; Chere-muchor).—Nikolski, Zap. Imp. Akad. Nauk, S. Peterburg, (8) XVII, no. 1, 1905, p. 326 (Amurland, Ussuri, etc.).

No specimen of this form is available for detailed description, which, moreover, seems to be unnecessary, as the chief difference is believed to consist in the greater number of ventrals and greater average of scale rows and supralabials, features previously discussed (pp. 450–456).

Habitat.—This form has a wide distribution from the Gulf of Tartary and the Sea of Japan, in the East, through southern Siberia and Mongolia to the Government of Tomsk and eastern Turkestan, in the West consequently extending over more than 50 degrees of longitude. At its eastern boundary it has been found as far north as Cape Tyr (above Nikolayevsk), on the Amur, and Decasties Bay, on the Gulf of Tartary. On the west shore of the Sea of Japan it goes southward at least to Possiet Bay. It seems to be common all over the Ussuri and Amur country, as well as along the coast, where, in addition to the localities already mentioned, it has been collected at Vladivostok and Olga Bay.

List of specimens of Agkistrodon blomhoffii intermedius.

Stockholm Mus. No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Oculars.	Temporals.	Supralabials.
1806	Female	Altai, Siberia	1875	Slowzoff	25	172	1	43	2,2	2+4	8
1807	Male	do	1875	do	21	175	1	51	2,2	2+3	7-8
1808	Female	do	1875	do	23	163	1	47	2,2	2+3	8
1809	do	do	1875	do	23	171	1	46	2,2	2+3	7-8
1810	Male	do	1875	do	23	161	1	53	2,2	2+3	8
1811	do	do	1875	do	23	166	1	47	2,2	2+3	7

Genus TRIMERESURUS,[a] Lacépède.

1804. *Trimeresurus* Lacépède, Ann. Mus. d'Hist. Nat. Paris, IV, p. 209 (type, *T. viridis*).
1822. *Trimeresura* Fleming, Philos. Zool., II, p. 291 (emendation).
1830. *Megæra* Wagler, Syst. Amph., p. 174 (type, *Vipera trigonocephala*).
1830. *Atropos* Wagler, Syst. Amph., p. 175 (type, *Trigonocephalus puniceus*) (not of Oken, 1815).
1830. *Tropidolæmus* Wagler, Syst. Amph., p. 175 (type, *Cophias wagleri*).
1839. *Trimesurus* Swainson, Classif. Fish. Amph. Rept., II (Lardner's Cab. Encycl.), p. 363 (emendation).
1843. *Botrophis* Fitzinger, Syst. Rept., p. 28 (type, *T. viridis*).

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[a] From *τριμερής*, divided into three parts; *οὐρά*, tail.

The snakes of this genus are distinguished from *Agkistrodon* at the first glance by the absence of the regular shields on top of the head, which are here replaced by scales more or less similar to those of the body.

It has not been demonstrated conclusively that they are generically identical with the numerous American pit-vipers of a similar head scutellation, and which are usually known as *Trigonocephalus* or *Bothrops*. The South American genus *Lachesis* is sufficiently characterized by the peculiar scutellation of the tail.

It is not even certain that all the snakes here enumerated as *Trimeresurus* really belong to the same genus. There are various indications that *T. gramineus* represents a group of species which might profitably be separated from the others As a matter of fact, until the cranial structure of all the various forms which make up the bulk of the *Crotalidæ* is known, generic combinations must be very uncertain in this family.

KEY TO THE SPECIES OF TRIMERESURUS OCCURRING IN FORMOSA AND THE RIU KIUS.

- a^1 A squarish loreal shield between nasal and upper preocular; nasal divided or semi. divided; tail normal; color brownish.
  - b^1 A single elongate subocular; more than 175 ventrals; more than 65 subcaudals.
    - c^1 Less than 30 scale rows.
      - d^1 More than 195 ventrals........................*T. mucrosquamatus*, p. 467.
      - d^2 Less than 195 ventrals................................*T. elegans*, p. 470.
    - c^2 More than 30 scale rows..............................*T. flavoviridis*, p. 475.
  - b^2 A series of several small suboculars; less than 155 ventrals; less than 60 subcaudals..*T. okinavensis*, p. 479.
- a^2 An elongate canthal shield between nasal and upper preocular; nasal flat, undivided; tail prehensile; color green.......................*T. gramineus*, p. 480.

The five forms here recognized occur within our territory only in Formosa and the Riu Kiu Archipelago. *T. gramineus* extends from the eastern Himalayas to Formosa, but has not as yet been found in the islands to the northeast of the latter. It represents a group of species not very closely allied to the other four. These fall again into two well-defined groups, viz, *T. okinavensis* on the one hand, and *T. mucrosquamatus*, *elegans*, and *flavoviridis* on the other. The last three are plainly of common origin, and *T. mucrosquamatus*, which is supposed to occur in Assam as well as in Formosa, may consequently be regarded as the mother species,[a] *T. elegans* having developed from it on the southern group of the Riu Kius by a decrease in the number of scales and scutes, while *T. flavoviridis* which became isolated in the middle and northern groups developed in the other direction, viz, by an increase in scale rows. *T. okinavensis*, finally, has thus far only been found in the central and northern groups, and no near relative is known either from the southern Riu Kius or from

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[a] See pp. 467–468 for a discussion of this species and its relation to *T. jerdonii*.

Formosa. Nevertheless, it is possible to trace the origin of this form also to the eastern Himalayan region, as its nearest and apparently quite close relative is *T. monticola* which ascends to 8,000 feet in the Himalayas and extends east into China at least as far as the province of Szechuen. That this species, or closely allied forms, have not as yet been found in Formosa and the intervening territory is not so surprising when we consider how little we know of the fauna of this region, and I have but little doubt that such a link connecting the habitat of *T. monticola* and *T. okinavensis* will be discovered some day.

Reverting to the *T. mucrosquamatus-elegans-flavoviridis* group, it is evident that while *T. elegans* is geographically intermediate it is not so located systematically and phylogenetically, but that this form and *T. flavoviridis* have developed independently and in several respects in opposite directions—from *T. mucrosquamatus*—in other words, that in extending eastward and northward after having reached Formosa, the ancestor of *T. flavoviridis* did not invade the central Riu Kiu group (Okinawa-Oshima) by way of the southern (Yaeyama) group. The difference in the geological structure of these two groups, as demonstrated by Doctor Yoshiwara recently, probably accounts for this apparent incongruity, as their connection with Formosa may have occurred at different geological periods.

TRIMERESURUS MUCROSQUAMATUS[a] (Cantor).

1839. ?*Trigonocephalus mucrosquamatus* Cantor, Proc. Zool. Soc. London, 1839, p. 32 (type-locality, Naga Hills, Assam).—*Trimeresurus mucrosquamatus* Guenther, Rept. Brit. India, 1864, p. 390 (type lost).

1870. *Trimeresurus mucrosquamatus* Swinhoe, Proc. Zool. Soc. London, 1870, p. 411, pl. xxxi (Formosa).—Fischer, Abh. Naturw. Ver. Hamburg, IX, 1886, No. 6, p. 18 (South Formosa); Jahrb. Wiss. Anst. Hamburg, V, 1888, p. 21 (South Formosa).—Boulenger, Fauna Brit. India, Rept., 1890, p. 428 (Assam; Formosa).—Stejneger, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 225 (Taipa, Formosa).—*Lachesis mucrosquamatus* Boulenger, Cat. Sn. Brit. Mus., III, 1896, p. 552 (Formosa).—Wall, Proc. Zool. Soc. London, 1903, p. 99 (Formosa).

Cantor's original specimen which came from Naga Hills, Assam,[b] has been lost, and no specimens from that locality have been recorded since. As the description is exceedingly brief it is consequently not absolutely certain that the Formosan specimens have been correctly identified as *T. mucrosquamatus*. However, the number of ventrals and subcaudals, respectively 218 and 91, agrees very well, and in view of the close relationship of many Formosan snakes with those of the Himalayan region it would be too rash to deny the possibility of their identity.

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[a] Signifying *mucro*, a sharp point, *squamatus*, scaly; hence, with pointed scales.

[b] Boettger (Offenbach. Ver. Naturk. 26–28 Ber., 1888, p. 153) suggests a confusion with "Nafa Hills," Okinawa shima, in which case Cantor's name would antedate Hallowell's *T. flavoviridis*. There is not the slightest probability, however, that Cantor had any Riu Kiu specimen before him.

Nevertheless, I wish to put on record my suspicion that the Naga Hills and the Formosa specimens represent separate local developments of *Trimeresurus jerdonii* of Guenther,[a] also from Assam, but occurring all the way from Tibet to Ichang on the upper Yangtsekiang. The scale formula of Cantor's specimen, the type of *T. mucrosquamatus*, precludes its being identical with *T. jerdonii*, but the latter comes pretty close to *T. elegans*, from the southern Riu Kius, with which it also agrees very well in coloration.

Description.—Adult male; Science College Museum, Tokyo, No. 6; Taipa, Formosa; October, 1897; T. Tada, collector. Rostral somewhat broader than high, barely visible from above; three small scales behind the truncate upper edge of the rostral between the anterior nasals; six scales, including the turned-over upper anterior corner of anterior nasal, covering the canthus rostralis, the one adjoining the latter being elongate and largest; supraoculars rather narrow, about one-third as wide as interocular space; 15 scales in a line between supraoculars; nostril in the posterior margin of the anterior nasal which is much larger than the posterior, its upper anterior corner being turned over on the canthus rostralis; two small loreals, one behind the other, on a line with and of the same width as the upper preocular; two long preoculars, of which the lower is much narrower than the upper, but as long as the latter and posterior loreal together, and forming the upper edge of the pit; three postoculars, including a long, narrow, crescentic subocular which anteriorly is separated by one scale from the subfoveal shield; subocular separated from third supralabial by one scale and from fourth by two series of scales; temporals numerous, the upper smaller, scale-like, convex, the lower somewhat larger, flat; 9 supralabials (on left side only 8 by fusion of fifth and sixth), second forming the anterior border of pit, and with third, fourth, and fifth the largest supralabials, sixth to tenth suddenly much smaller, not larger than the adjacent temporals; first supralabial which is separated from anterior loreal by two scales is of the same size as the last ones; two lower labials only in contact with anterior chin-shields, third and following ones being separated from them by scales; posterior chin-shields scarcely differentiated and separated by a pair of scales; 27 rows of pointed scales, all strongly keeled and with two faint apical pores, except the outer one which is only feebly keeled at base; 206 ventrals; anal entire; 95 pairs of subcaudals. Color (in alcohol) above drab with a median series of irregular transverse, dark brown, black-rimmed and very narrowly white-edged spots, consisting of two halves, one on each side of median line and not always evenly joined, in which case sometimes a zigzag band is forming by connection with succeeding spots; directly under each dorsal spot a smaller lateral spot of the same color, these lateral spots disappearing on sides of neck and tail; top of head with a distinct pattern of dark brown lines diverging from snout backward and forming a lozenge-shaped figure on occiput in the center of which an elongate dark line; a narrow dark line from upper corner of the crescentic subocular over the temporal region to beyond the angle of mouth passing above it on the scale above the last supralabial; lips uniform pale; underside pale drab with several irregular series of large roundish, dark-edged whitish spots, often transversely oblong, and not extending over more than one shield.

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[a] Proc. Zool. Soc. London, 1875, p. 233, pl. XXXIV (type-locality, Khasi Hills, Assam; types in Brit. Mus.; Dr. T. C. Jerdon, collector).

Dimensions.

	mm.
Total length	780
Snout to vent	588
Vent to tip of tail	192

This snake undoubtedly grows to be more than 1 meter long.

The *young* (Sci. Coll. Mus. Tokyo, No. 18) is colored essentially as the adult, but the contrast between ground-color and the dark spots is greater, and on the former, between the latter, there is on the sides a shadowy pale brownish gray vertical line; the sides of head, including labials, are not pale, but dark brown, especially a broad vertical band on second supralabial, though not as dark as the postocular stripe which is bounded below by a whitish line and several of the labials and temporals are bordered behind by a narrow whitish mark.

Structurally the only difference from the adults consists in the upturned outer edge of the supraocular.

Variation.—The number of scale rows in this form is fairly constant, nine out of eleven specimens having 27 and only two 25 rows; in the same number of specimens the ventrals vary only between 200 and 216, and the subcaudals between 76 and 95. The supralabials are more variable, namely, 8 to 11. U.S.N.M. No. 36515 has 10 on each side, a small labial having been interpolated between third and fourth.

Habitat.—*T. mucrosquamatus*, as here understood, is only known with absolute certainty from Formosa, where it seems to be fairly common in the lowlands, since nearly all who have collected there obtained specimens. It is assumed that it is the same form which was originally described by Cantor, in 1839, from the Naga Hills in Assam, but it has not been collected there since that time, nor has it been found in the intermediate territory of the Chinese mainland.

It is unquestionably related, however, to a species which occurs from Assam and Tibet as far east as Ichang on the Yangtse, viz, *T. jerdonii.* It is at least equally closely allied to *T. elegans* on the islands of the southern Riu Kiu group, while *T. flavoviridis* from the Okinawa-Oshima group is slightly more differentiated.

List of specimens of Trimeresurus mucrosquamatus.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Interorbitals.	Supralabials.
U.S.N.M	36515	Male[a]	Taipa, Formosa	1897. Nov.—	T. Tada	27	205	1	91	15	10
Sci.Coll.Tokyo.	6	....do.[b]	.....do	Oct. —	.....do	27	206	1	95	15	8-9
Do	18	Young	.....do	Oct.	.....do	27	202	1	78	14	8
Oldenburg	*a*	Adult[c]	South Formosa.	1888.	Ruhstrat	27	216	....	90	....	....
Do	*b*	....do.[c]	.....do	1888.	.....do	27	216	....	90	....	....
Do	*c*	Young[c]	.....do	1886.	.....do	27	214	....	81	....	....
Brit. Mus	*a*	Male[d]	Takow, Formosa	....	R. Swinhoe	25	200	1	92	....	....
Do	*b*	Female[d]	Formosa	....	.....do	27	214	1	76	....	....
Do	*c*	Young[d]	Central Formosa.	....	Holst	27	211	1	89	....	....
Do	*d*	....do.[d]	South Formosa	....	J. G. Fischer	27	210	1	90	....	....
Do	*g*	Male[e]	South Cape, Formosa.	....	J.D.La Touche.	25	211	1	91	....	....

[a] Total length, 932 mm.
[b] Description, p. 468.
[c] Fischer, p. 18.
[d] Boulenger, Cat. III, p. 552.
[e] Boulenger, MS.

TRIMERESURUS ELEGANS[a] (Gray).

1849. *Craspedocephalus elegans* Gray, Cat. Sn. Brit. Mus., p. 7 (type-locality, "west coast of (North?) America?"; types, Brit. Mus., Nos. 47. 3. 4. 62 and 64; Sir E. Belcher, collector) (not *Trimesurus elegans* Gray, 1853).

1895. *Trimeresurus luteus* Boettger, Zool. Anz., XVIII, July 8, 1895, p. 269 (type-locality, "Miyakoshima," Riu Kius; type in Mus. Senckenberg.; Schmacker, collector); Offenbach. Ver. Naturk. 33–36 Ber., 1895, p. 111 ("Miyakoshima.")—*Lachesis luteus* Boulenger, Cat. Sn. Brit. Mus., III, 1896, p. 553.—*Lachesis lutea* Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 139 ("Miyakoshima.")

1906. *Lachesis mucrosquamatus* Wall, Proc. Zool. Soc. London, 1905, II, p. 516 (Miyako; Iriomote) (not of Cantor).

The types of *Craspedocephalus elegans* in British Museum are enumerated under *Lachesis mucrosquamatus* by Boulenger in his catalogue, but their lower number of ventrals precludes their annexation to that species. Boulenger does not seem to have known *T. luteus* from autopsy, and in his key to the species on page 532 he fails to point out any difference between the two species. The chief difference shown in his descriptions (pp. 552 and 553) consists in the "temporal scales smooth" in *T. mucrosquamatus* and "temporal scales keeled" in *T. luteus*, but this character is not reliable.

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[a] Signifying elegant.

The locality whence Captain Belcher obtained the specimens upon which Gray established the new species is not known. Gray suggested "west coast of (North?) America?" By a study of Belcher's itineraries both in the *Sulphur* and in the *Samarang* I have come to the conclusion that the only likely place where he can have obtained the specimens in question is Ishigaki shima, an island in the southern group of the Riu Kius, where he stayed some time and undertook considerable surveying on shore[a], the very same island whence come two of the specimens of this species examined by me. In fact I have but little doubt that Ishigaki shima is the true type-locality.

With regard to the probability of this island also being the type-locality of *T. luteus*, see remarks farther on under *habitat* of this present species (p. 474).

Thanks to the courtesy of Doctor Boulenger, I have been able to examine Gray's types of *C. elegans*. They consist of two young specimens, No. 47.3.4.62, with the upper edge of snout and supraoculars turned up, and with the temporals slightly but distinctly keeled, and No. 47.3.4.64, an adult male, with temporals scarcely keeled. There is, therefore, no doubt in my mind that Boettger's *T. luteus* is the same.

T. elegans is very closely allied to the Formosan *T. mucrosquamatus*, and while there are various average characters which separate the two, the number of ventrals is the only one which seems to offer an absolutely reliable diagnosis. In all the specimens of *T. elegans* examined by me the supraoculars have the outer edge sharply turned up, but in the only small Formosan specimen before me (Sci. Coll. No. 18) this edge is similarly turned up. Neither the keeling of the temporals, nor the size of the canthal scales offer any stable characteristics.

In the three specimens of each species now before me—the only ones I can now examine with regard to this character—I find another difference, viz, that in the three Formosan *T. mucrosquamatus* there are two loreals, one behind the other, followed by a long horizontal upper preocular, while in the three Riu Kiu *T. elegans* there is only a single loreal between the nasal and the elongate preocular.

Additional characters may be found in the lower number of supralabials, the somewhat wider supraoculars, and resultant narrower interorbital space in *T. elegans* as well as in the lower number of scale rows, characters, however, which intergrade and offer no hard and fast line of separation. The coloration is essentially the same, with a tendency, however, to a less definite arrangement of light and dark spots on the underside and to a more or less complete obliteration of the lateral spots.

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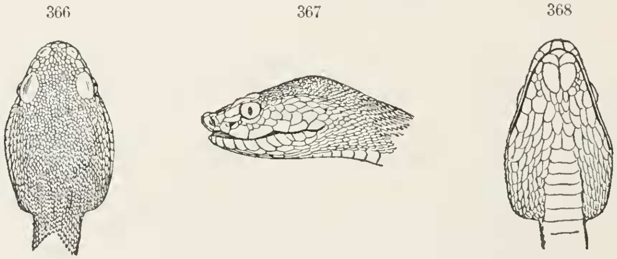
[a] The "examination of Pa-tchung-san" [Ishigaki shima] "occupied us twenty-one days," Belcher, Narrative Voy. Samarang, I, 1848, p. 75.

See also Doctor Adams's reference to a species of "*Trigonocephalus*" in the Meiaco-shima group in his "Notes from a Journal of Research into the Natural History of the Countries visited during the Voyage of H. M. S. *Samarang* under the command of Capt. Sir E. Belcher, C. B.," in Belcher's Narrative Voy. Samarang, II, 1848, pp. 305 and 306. This may be an allusion, however, to *Agkistrodon affinis*.

Description (figs. 366–368).—*Young;* Science College Museum, Tokyo, No. 19; Iriomote shima; 1887; Tashiro, collector. Rostral broader than high, barely visible from above, bordered behind by two scales which separate the anterior nasals, the latter not turned over the canthus rostralis to the upper surface of the snout; two larger scales on canthus rostralis, the anterior separated from the rostral and from the posterior one respectively by a small scale and the latter by a similar scale from the supraocular, the outer edges of these scales being raised like that of the supraoculars; upper head scales small, smooth, 13 in a row between supraoculars, which are somewhat more than one-third as wide as interorbital space; posterior nasal smaller than anterior, followed by a single squarish loreal, behind which an equally broad, elongate upper preocular; a second, much narrower and somewhat longer preocular forms the upper edge of the pit; three postoculars, including the long, narrow crescentic subocular which reaches the subfoveal, and is separated from fourth supralabial by two rows of scales; upper temporals weakly keeled, lower ones smooth, those bordering the supralabials larger than the latter; 7 supralabials, first small; second forming the anterior border of the pit, third largest, fourth long, but perceptibly lower than third, and not much higher than those following; three lower labials in contact with anterior chin-shields, which are larger than the posterior ones; scales pointed, in 23 rows, all strongly keeled, except outer row which is smooth; 188 ventrals; anal entire; 72 pairs of subcaudals. Color (in alcohol) pale brownish gray above; a series of darker brownish blotches, with paler centers, along the middle of the back, the respective halves of each blotch on each side of the median line not always fitting together, but sometimes even completely alternating and thus forming in places an interrupted zigzag band; tip of tail uniform light-colored (yellow?); on the sides obscure traces of a dark spot below each dorsal blotch; a somewhat ill-defined



Figs. 366-368.—Trimeresurus elegans. nat. size. 366, top of head; 367, side of head; 368, underside of head. No. C 40, High School, Kumamoto.

brownish band on top of head covering the two scale rows nearest to the supraoculars and extending backward to the neck; a well-defined dark-brown band or line, one scale wide, starting from the posterior margin of the orbit below the center of the eye and extending backward beyond the angle of the mouth passing the latter on the scale row above the last supralabial; a dark brown vertical line on the posterior half of the second supralabial from the pit to the edge of the lip, lower surface pale buff with ill-defined markings of pale brownish gray.

Dimensions.

	mm.
Total length	370
Snout to vent	305
Vent to tip of tail	65

In the *adult male* from Ishigaki shima the coloration is essentially as described above, but the lateral series of spots, one below each dorsal blotch, is as well marked and dark colored as the latter; tip of tail is without dark cross-bars but is not paler than the basal portion. This specimen (Sci. Coll. Mus. Tokyo, No. 18) measures 655 mm. in total length, of which the tail is 123 mm. This is considerable less than the length reached by the species, as one of the types, according to Doctor Boettger, measures 945 mm.

The edge of the supraocular is turned up in all the specimens, but according to my observations on the specimens in the Hamburg Museum less so in the old specimens than in the young ones.

Variation.—The present species is rather variable so far as the scutellation of the head is concerned. In Boettger's types of *T. luteus*, which he kindly allowed me to examine in 1898, the scales covering the canthus rostralis are small and irregular. Of four specimens in the Hamburg Museum two have one large canthal scale followed by three small irregular ones, while two have two large scales followed by a small one, and of the three specimens before me two have one and one two enlarged canthal scales. In his types, the temporal scales are rather strongly keeled; in the Hamburg specimens three of the specimens have the upper temporals more or less strongly keeled, in the fourth one the keels are only faintly indicated, and so they are in my specimens. In one of the types of *T. elegans* the temporals are slightly, but distinctly keeled, as already stated. Usually there are two rows of scales between the subocular and the labials, in one Hamburg specimen (No. 2582) only one such row. The number of scales between the supraoculars varies between 10 and 13. Supralabials probably most commonly 7, but one of my specimens has 8 on both sides, and two have 7 on one side, 8 on the other. In the specimen in the Kumamato Fifth Higher Middle School the long upper preocular is divided vertically near the eye on both sides.

Of 13 specimens eight have 25 scale rows and five have 23. Doctor Wall records one with 24 scale rows. Ventrals vary between 183 and 191, subcaudals between 66 and 77.

The variation in color seems to be less great and consists in the more or less perfect obliteration of the lateral series of spots, and in the greater or less definite outline of the light and dark spots on the underside.

Remarks by collector.—Mr. Tashiro has furnished the following note with the larger specimen collected by him on Ishigaki shima:

"This species is not found on Okinawa shima, but is confined to the Yaeyama Islands. It is known by the name of 'Habu,' the general name applied to the snakes of this genus, of which there are about five varieties, each with a special name. It lives in crevices in stone-walls, hollow trees, etc. Its habits are more sluggish than the real 'habu' (*Trimeresurus flavoviridis*). The natives say that it is less poisonous than the latter, yet I think it is by no means inferior in this respect."

Habitat.—This species is confined to the southern group of the Riu Kius, and seems to be fairly common both on Iriomote shima and on Ishigaki shima. Boettger's types of *T. luteus* are said to have come from "Yaeyama auf Mijako shima," a somewhat confusing statement which might have been suspected of meaning "Miyako shima of the Yaeyama group," as formerly at least that island was considered part of the group, though now excluded as a special subgroup, but in the introduction to his paper[a] Doctor Boettger says:

> "Aber die Thiere scheinen leider nicht genau nach den Fundorten getrennt worden zu sein * * * Die Schlangen sollen zum grössten Theil von Yaeyama oder Patchungsan, einer der Miyako shima Inseln, herstammen."

But Patchungsan is the Chinese name for Ishigaki shima, and Doctor Boettger evidently uses Miyako shima as the collective name of the two southern subgroups. It is therefore exceedingly dubious if the types came from Miyako shima proper, and the probability is that they really originate from Ishigaki shima. That the same species occurs on Miyako shima has now been shown by Doctor Wall who records three specimens from that island under the name of *Lachesis mucrosquamatus*.

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[a] Offenbach. Ver. Naturk. 33–36 Ber., 1895. p. 101.

List of specimens of Trimeresurus elegans.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Interorbitals.	Supralabials.
Sci. Coll. Tokyo.	19	Young [a]	Iriomote shima.	1887	Tashiro.........	23	188	1	72	13	7
Do.....	18	Male....	Ishigaki shima.	1887. Oct. —	.....do..........	25	183	1	72	12	8
Kumamoto	C(40)	Young..	.....do.........	1891	....	25	185	1	76	10	7
Hamburg..	2578*a*	....do...	Iriomote shima	1897	Doctor Lenz....	23	187	1	72	11	7-8
Do.....	2578*b*	....do...	.....do.........	1897	.....do..........	25	....	....	....	.....	7-8
Do.....	2582	Female .	.....do.	1897. Mar. 13	.....do..........	23	191	1	....	11	7
Brit. Mus..	47.3.4.64	Male [b] ..	[Ishigaki shima"]	....	Capt. E. Belcher.	25	187	1	76	.....	....
Do.....	47.3.4.62	Young [b]	.....do.........	....	.....do..........	25	183	1	72	.....	....
Senckenberg.	9553*a*	Adult [c] .	"Miyako shima."	....	B. Schmacker ..	23	182	1	72	12-13	7-8
Do.....	....	....do. [c] ..	.....do.........	....	.....do..........	25	186	1	74		

[a] Description, p. 472 [b] Types of *T. elegans*. [c] Types of *T. luteus*.

TRIMERESURUS FLAVOVIRIDIS [a] (Hallowell).

HABU.

Plate XXVII.

1860. *Bothrops flavoviridis* Hallowell, Proc. Phila. Acad., 1860, p. 492 (type-locality, "Amakarima" Island = Kerama shima, middle group, Riu Kius).—Boulenger, Proc. Zool. Soc. London, 1887, p. 149 ("Loo Choo" Islands).—? Okada, Cat. Vert. Japan, 1891, p. 70 (Okinawa shima).—? Fritze, Zool. Jahrb. Syst., VII, 1894, p. 860; author's separate, p. 11 (Okinawa).—*Trimeresurus flavoviridis* Boulenger, Fauna Brit. India, Rept., 1890, p. 425 (Loo Choo).—*Lachesis flavoviridis* Boulenger, Cat. Sn. Brit. Mus., III, 1896, p. 550 (Okinawa).—Boettger, Kat. Schl. Mus. Senckenberg., 1898, p. 139 (O-shima, "Liu Kiu gruppe").—Brown, Proc. Phila. Acad., 1902, June 11; p. 185 ("Loo Choo Islands").—Schenkel, Verh. Naturf. Ges. Basel, XIII, Pt. 1, —, p. 179 (Okinawa).—Wall, Proc. Zool. Soc. London, 1903, p. 102 (Loo Choos); 1905, II, p. 516 (Amami; Okinawa).

1880. *Trimeresurus riukiuanus* Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 118, pl. —, figs. 6–10 [b] (type-locality, District Nase, O-shima; types, Nos. 9767–9768, Berlin Mus.).—Doederlein, Mitth. Deutsch. Ges. Ost-Asiens, III, 1881, p. 149 (Amami-o-shima).—Landois, Westfal. Prov. Ver. 16 Ber., 1887 (p. 45).—Fischer, Jahrb. Wiss. Anst. Hamburg, V, 1888, p. 20 (Okinawa shima).—Okada, Cat. Vert. Japan, 1891, p. 70 (Okinawa; O-shima).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 860; author's separate p. 11 (Amami-o-shima; Okinawa shima).

The type of Hallowell's *Bothrops flavoviridis* which, according to his statement, was much mutilated (only 61 ventrals could be counted) has apparently been lost. From Doctor Stimpson's MS. catalogue it is learned that the "viper," as he calls it, was "killed on one of the Amakirrima Isles (Loo Choo) by Mr. Macomb of the *Hancock*, April 1855," consequently on one of the small islands composing the Kerama shima group just west of the south end of Okinawa shima.

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[a] Signifying yellowish green. [b] Reproduced in this work on Plate XXVII.

Hilgendorf's *Trimeresurus riukiuanus* on the other hand was described from specimens obtained in the Nase district on Amami-o-shima, the principal island of the northern group. The scale formulas of the specimens from both groups agree very well, and a direct comparison of a few specimens does not reveal any essential difference. The material at hand, viz, one from the northern group and two from the middle group, is not conclusive, however. The former seems to have a somewhat longer snout with more, or smaller, scales between the supraoculars, but until verified in large series from both groups the two names must be regarded as synonymous. The low number of scale-rows assigned to his specimen by Hallowell, viz, 31, is evidently due to the fact that the specimen was mutilated.

Okada in his List of the Vertebrates of Japan enumerated both *T. flavoviridis* and *T. riukiuanus* as separate species, though possibly he included the former with *T. okinavensis* which was not then described. Doctor Fritze, however, enumerates all three from Okinawa. Inasmuch as he seems actually to have examined specimens of two species it is probable that the one from Tokushimura was really a *T. okinavensis* although enumerated as a *T. flavoviridis*.

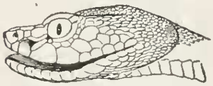
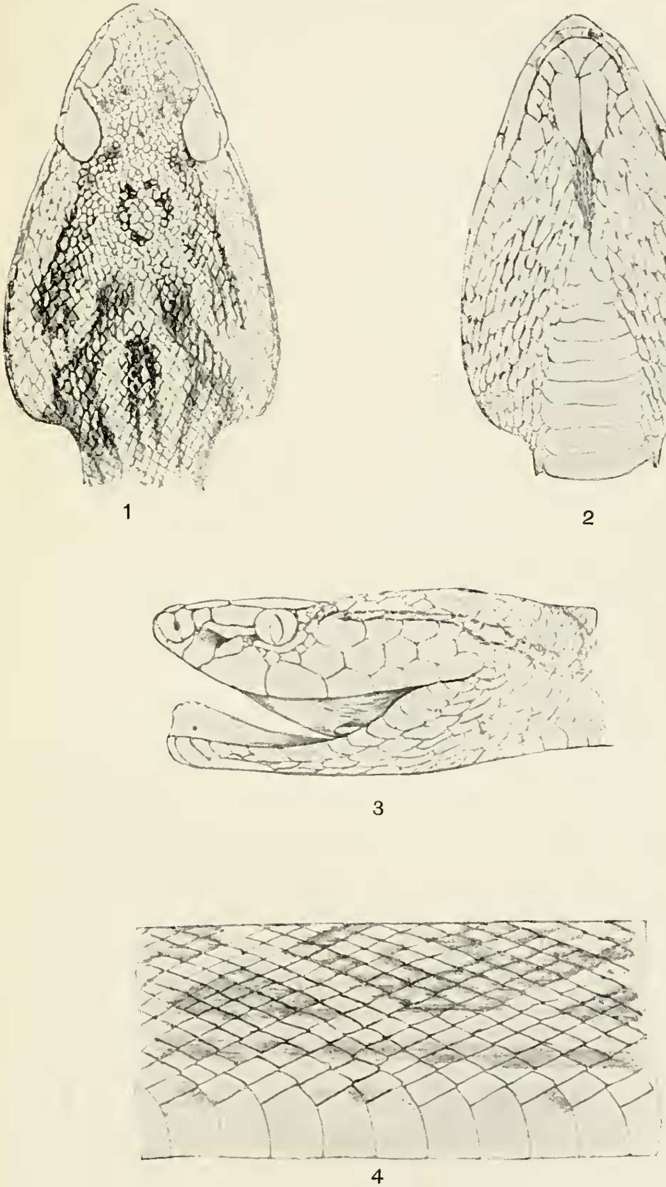


FIG. 369.—TRIMERESURUS FLAVOVIRIDIS. NAT. SIZE. SIDE OF HEAD. NO. 16, SCI. COLL. TOKYO.

Description (fig. 369).—*Halfgrown female;* U.S.N.M. No. 31818; Amami-o-shima, Riu Kiu; Dr. H. M. Smith collection. Rostral almost as high as broad, nearly triangular, the sutures with first supralabials and internasal being very short, just visible from above; a single small scale behind the rostral separating the anterior nostrils; four or five shields, including the anterior nostrils, forming the raised canthus rostralis between rostral and supraocular, the shield second from the supraocular being the largest; supraocular long, pointed anteriorly, half as wide as interocular space; upper head scales smooth, small, about 13 in a line between the supraoculars; nostril round, in the posterior margin of the anterior nasal which is turned over the canthus rostralis to the upper side of the head; loreal nearly rectangular, slightly longer than high; two preoculars, very elongated, both in contact with loreal, the upper nearly twice as long as the latter, the lower, which forms the upper posterior border of the pit, much narrower than the upper; a long narrow shield bordering the pit below, separated from long subocular by a couple of small scales; eye rather large, vertical diameter equaling its distance from edge of lip; a very long narrow crescentic subocular



TRIMERESURUS FLAVOVIRIDIS. (FROM HILGENDORF.)

FOR EXPLANATION OF PLATE SEE PAGE 555.

separated from the lower preocular and from the subfoveal by several small scales; from the fourth supralabial by two rows of scales, and from the temporals by a single row of smaller scales; one postocular on left side, three on right, in adition to suboculars; lower temporals large, upper ones small, smooth scales; 8 supralabials, first subtriangular, second forming the anterior border of the pit, third largest, fifth to eighth small, low; three lower labials in contact with anterior chin-shields, fourth and fifth being separated from them by scales; anterior pair of chin-shields much larger than posterior, which are scarcely differentiated from the other postgeneials and separated by a pair of smaller scales; 35 rows of narrow pointed scales, of which all except the outer are keeled and provided with two apical pits; 226 ventrals; anal undivided; tail defective, subcaudals 73+, very few missing. Color (in alcohol) above very pale isabella-color, on each side of the median line with a series of elongated darker brownish spots, which are nearly in pairs anteriorly but alternating on the posterior two-thirds, mostly anastomosing across the median line; on the sides a similar but very obscure series; on the upper side of the tail the spots become united to regular cross-bars; occiput with a very obscure pattern of several elongate divergent spots; sides of head whitish with a narrow brown line from upper corner of subocular across the temples to the sides of neck, one scale above last supralabial; all the brown markings are dark-edged with paler centers; underside uniform whitish.

Dimensions.

	mm.
Total length	612
Snout to vent	517
Vent to tip of tail	95

This species grows to a considerable size. Hilgendorf's types of *T. riukiuanus* are 1.380 and 1.555 m., and Doctor Fischer records two specimens measuring 1.433 and 1.285 m., respectively. A snake of this kind over 5 feet long must be a pretty dangerous reptile.

Variation.—The number of scale rows shows considerable variation, viz, from 33 to 37, though 35 seems to be the normal number, inasmuch as in 13 specimens more than two-thirds have this number. Doctor Wall records a specimen with 40 scale rows. Ventrals vary between 222 and 234, subcaudals between 75 and 90. Supralabials usually 8, but a specimen in the Hamburg Museum has 7 on one side, and other specimens are on record as having 9.

The size of the small scales on top of the head is not so variable as the figures given for the number of scales on a line between the supraoculars, namely, from 7 to 13 would indicate, since the discrepancy depends chiefly upon the irregular size of these scales on the interocular region.

The two specimens from Okinawa before me are smaller than the one described above and show a more definite color pattern. The lateral markings are so light as to be almost lost while the dorsal blotches are shorter, with a greater tendency to combine into median transverse marks across the middle line, thus forming angular cross-bars deeply notched in front and behind and with a large pale spot on each side of the median line. The pattern on the top of the head is also very sharply defined and formed as shown in Hilgendorf's figure of his type of *T. riukiuanus* (Plate XXVII, fig. 1 of this work).

Habitat.—This dangerous snake is confined to the islands of the Okinawa and Ō-shima subgroups of the Riu Kiu Archipelago, in some of which it appears to be rather common. Amami-o-shima, and—according to Doederlein, also Kome shima, are particularly notorious for the occurrence of the "habu," while both he and Fritze assert that it is much less common in Okinawa shima.

It is represented by closely allied species in the southern group and in Formosa.

List of specimens of Trimeresurus flavoviridis.

Museum.	No.	Sex and age.	Locality.	When collected.	By whom collected or from received.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Interorbitals.	Supralabials.
	......	(a)	"Amakarima Island."	1855. April	Mr. Macomb....	31	....	....	81	....	8
U.S.N.M...	31818	Female[b]	Amami-o-shima..	....	Dr. H. M. Smith.	35	226	1	....	13	8
Sci. Coll. Tokyo.	16	Young[c]	Oshiro mura, Okinawa shima.	1887. May 10	Tashiro.........	35	222	1	87	9	9
Imp Mus. Tokyo.	9	....do...	Okinawa shima...	....	....	35	223	1	86	11	8
Hamburg..	1540	....do...	.....do...........	....	Doctor Warburg.	35	227	1	80	9	7-8
Brit. Mus..	*a*	Female[d]	.....do...........	....	Dr. J. G. Fischer.	35	225	1	80	....	....
Do.....	*b*	....do.[d]	.....do...........	....	.....do..........	37	225	1	76	....	....
Do.....	*c*	Male[d]..	.....do...........	....	Mr. Holst......	35	231	1	90	....	....
Do.....	*d*	Young[d]	.....do...........	....	.....do..........	33	229	1	79	....	....
Do.....	*e*	Male[d]..	"Loo Choo Is."...	....	H. Pryer.......	33	223	1	86	....	....
Do.....	*f*	Young[d]	.....do...........	....	.....do..........	35	222	1	83	....	....
Do.....	*g*	....do.[e]	.....do...........	....	.....do..........	35	230	1	75	7 8	8
Berlin.....	9767	Adult[f]..	Nase, Amami-o-shima.	....	Doctor Hilgendorf.	35	226	1	84	....	8
Do.....	9768	....do.[f]	.....do...........	....	.....do..........	37	228	1	86	....	8

[a] Type, specimen mutilated, the number of scale rows given is therefore probably not correct.

[b] Description, p. 476.

[c] Fig. 3 9.

[d] Boulenger. Cat. III, p. 550.

[e] Boulenger, Proc. Zool. Soc., 1887, p. 149.

[f] Types of *T. riukianus*, Hilgendorf, p. 118. The scale formulas as here given for each individual may not be exactly correct, as Hilgendor's statement is not quite explicit; however, they are correct for the two specimens together.

TRIMERESURUS OKINAVENSIS[a] Boulenger.

KUFAH (native name in OKINAWA SHIMA according to TASHIRO).

1892. *Trimeresurus okinavensis* Boulenger, Ann. Mag. Nat. Hist. (6), X, Oct. 1892, p. 302 (type-locality, Okinawa shima; types in Brit. Mus.; Holst, collector).—Fritze, Zool. Jahrb. Syst., VII, 1894, p. 861; author's separate, p. 12 (Okinawa).—*Lachesis okinavensis* Boulenger, Cat. Sn. Brit. Mus., III, 1896, p. 549, pl. xxv, fig. 2 (Okinawa).—Wall, Proc. Zool. Soc. London, 1905, II, p. 516 (Okinawa; Amami; Yaku).

1894. ? *Bothrops flavoviridis* Fritze, Zool. Jahrb. Syst., VII, p. 860; author's separate, p. 11 (Tokuchimura, Okinawa) (not of Hallowell?).

Description.—Adult female; Science College Museum, Tokyo, No. 17; Okinawa shima; March, 1887; Tashiro, collector. Rostral nearly as high as broad, scarcely visible from above; behind the truncated upper edge three scales of the same size as the other upper head scales in a line between the anterior nasals and the first canthal scale; four canthal scales between anterior nasal and supraocular decreasing in size posteriorly; supraoculars wider than one-third the interocular space; 8 scales on a line between the supraoculars; head scales flat, smooth anteriorly, faintly tubercular or keeled on parietal and occipital regions; nostril large, rounded, in posterior margin of anterior nasal which is much larger than posterior, its upper anterior edge just visible from above, but not turned over the canthal edge; a small loreal, nearly twice as long as high below second and third canthal scales, in contact behind with the two preoculars, of which the upper is twice as wide as the lower; pit very large; subfoveal shield entering eye below preoculars; eye rather small; three small suboculars separated from supralabials by two scale rows; two postoculars; temporal scales numerous, the upper ones small, keeled, the lower series next to the supralabials larger, smooth; 8 supralabials, first small, triangular, separated from loreal by one scale, second broad, forming anterior border of pit, third largest; two lower labials in contact with anterior chin-shield; posterior chin-shield scarcely differentiated; 23 rows of rather obtuse scales with obscure apical pits; all keeled, except outer row, but keels not reaching the tip of the scales; 128 ventrals; anal entire; 51 pairs of subcaudals. Color (in alcohol) above brownish gray, with large transverse blotches of brown anteriorly and posteriorly narrowly edged with dusky; a series of lateral spots on the middle of the sides, each one below the corresponding dorsal blotch of which it is a detached portion and with which it is not alternating; below and alternating with these another row of dark brown spots situated on the two outer scale rows and the adjacent part of the ventrals; a broad dark brown, black-edged band three scales wide from eye over temporal region to posterior end of lower jaw, its anterior border crossing the last supralabial at the corner of the mouth; above this a narrower whitish band, and a similar one below it on the last four supralabials, crossing to the lower jaw; sides of face anterior to this brown with two darker blotches across both lips at the level of second and fourth supralabial; on the lower lip a third similar dark brown blotch near the corner of the mouth; underside pale obscurely clouded with brownish.

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[a] From Okinawa.

Dimensions.

	mm.
Total length	445
Snout to vent	371
vent to tip of tail	74

Variation.—Supralabials vary between 8 and 7, ventrals between 127 and 134, subcaudals between 42 and 51 pairs in the three specimens which have thus far been recorded. Doctor Wall reports one specimen with 24 scale rows.

Habitat.—The few specimens known of this species have nearly all come from Okinawa shima. According to a recent paper by Doctor Wall the collector of Mr. Owston obtained not only four specimens in Okinawa shima, but also three in Amami-o-shima, and one in Yaku shima. The latter occurrence is so extraordinary, however, that it would be well to await corroborative evidence, as some mistake in the labeling may be possible.

As I have stated elsewhere, there is no near relative of this species known from Formosa, but as it is allied to the Himalayo-Chinese *Trimeresurus monticola*, the latter or a related form may be expected to occur in that island.

List of specimens of Trimeresurus okinavensis.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Interorbitals.	Supralabials.
				1887.							
Sci. Coll. Tokyo	17	Female[a]	Okinawa shima.	Mar. —	Tashiro	23	128	1	51	8	8
Brit. Mus	*a*	do.[b]	do		P. A. Holst	23	130	1	43	9	8
Do	*b*	do.[b]	do		do	21	129	1	47	6	7

[a] Description, p. 479.

[b] Types; Boulenger, Cat. III, p. 549

TRIMERESURUS GRAMINEUS[a] (Shaw).

1802. *Coluber gramineus* Shaw, Gen. Zool., III, Pt. 2, p. 420 (type-locality, Vizagapatam, India; based on Russell's Ind. Serp., I, pl. ix).—*Trimeresurus gramineus* Guenther, Rept. Brit. India, 1864, p. 385. Boettger, Ber. Senckenberg. Naturf. Ges., 1888, Abh. p. 188 (South Formosa); 1894, p. 135 (Hainan).—Boulenger, Fauna Brit. India, Rept., 1890, p. 429 (southern China, India, Malay Peninsula and Archipelago, etc.).—Stejneger, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 225 (Taipa, Formosa).—*Lachesis gramineus* Boulenger, Cat. Sn. Brit. Mus., III, 1896,

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[a] Signifying of grass, grassy; referring to its green color.

p. 554 (southeastern Asia; Formosa). WALL, Proc. Zool. Soc. London, 1903, p. 99 (Hongkong; Formosa).—*Lachesis graminea* BOETTGER, Kat. Schl. Mus. Senckenberg., 1898, p. 139 (south Formosa, etc.)

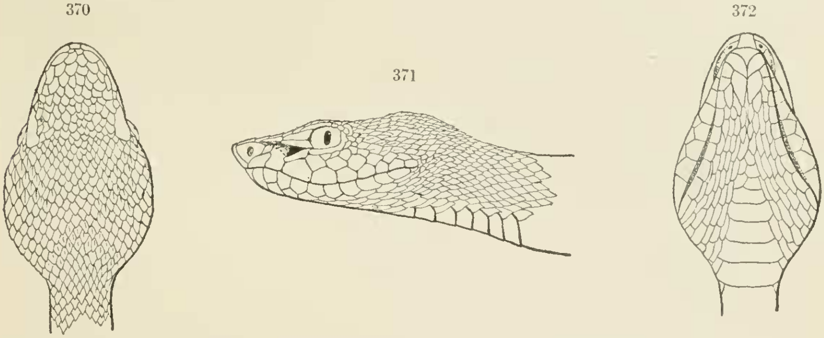
1802. *Coluber viridis* BECHSTEIN, Lacépède's Naturg. Amph., IV, p. 252, pl. XXXIX, fig. 1 (type-locality, Vizagapatam, India; based on Russell's Ind. Serp., I, pl. IX).—*Trimeresurus viridis* LACÉPÈDE, Ann. Mus. Paris IV, 1804, p. 209.

1839. *Trigonocephalus erythrurus* CANTOR, Proc. Zool. Soc. London, 1839, p. 31 (type-locality, Ganges Delta, India; type in Brit. Mus.; Cantor, collector.—*Trimeresurus erythrurus* GUENTHER, Rept. Brit. India, 1864, p. 386.—SWINHOE, Proc. Zool. Soc. London, 1870, p. 412 (Takow, Formosa).

1842. *Trimesurus albolabris* GRAY, Zool. Miscell., (p. 48) (type-locality, China; types in Brit. Mus.; Reeves, collector).

1853. *Trimesurus elegans* GRAY, Ann. Mag. Nat. Hist. (2), XII, p. 391 (type-locality, Sikkim; type in Brit. Mus.; Hooker, collector) (not *Craspedocephalus elegans* Gray, 1849).

Description (figs. 370–372).—*Adult male;* U.S.N.M. No. 36516; Taihoku (Taipa), Formosa; September, 1897; T. Tada, collector. Rostral as high as broad, very narrow above, nearly triangular bordered behind by a single scale between the upturned anterior corners of the nasal, just visible from above; canthus rostralis sharp, formed anteriorly by the upturned edge of the nasal, the upturned edge of an elongated shield corresponding to the loreal in the other species here described and the upturned portion of the upper preocular; head shields small, smooth anteriorly, keeled on parietal and occipital regions; supraoculars very narrow, occupying only the outer edge of the supraocular region, their width being scarcely more than one-fifth the distance between them; about 12 scales on a line between the supraoculars; nasal large, smooth, undivided, with a round nostril pierced near the lower edge; behind it above, on the canthal ridge an elongated shield, being the loreal of the other species; below it, separating it from the first supralabial, and between nasal and the upper portion of second supralabial which



FIGS. 370–372.—TRIMERESURUS GRAMINEUS. 1⅓ × NAT. SIZE. 370, TOP OF HEAD; 371, SIDE OF HEAD; 372, UNDERSIDE OF HEAD. NO. 2a SCI. COLL. TOKYO.

enters the pit, two small scales, one above the other, two elongate anterior preoculars, the upper, which is somewhat wider anteriorly turned up over the canthal ridge, the lower forming the upper border of the large pit; the subfoveal as large as the lower preocular, posteriorly entering eye between the latter and the subocular; a long, narrow, crescentic subocular anteriorly in contact with subfoveal, separated from fourth and subsequent supralabials by one and posteriorly two rows of scales; three small postoculars on left side, two on right; temporals numerous, lower ones largest, upper ones smaller, keeled; 10 supralabials, first small, triangular, second very high, forming anterior border of pit, third largest, fourth slightly larger than fifth to tenth, which are subequal; 3 lower labials in contact with anterior chin-shields, posterior chin-shields scarcely differentiated; 21 rows of narrow, pointed, keeled scales without apical pits; 161 ventrals; anal entire; 69 pairs of subcaudals; tip of tail rather blunt. Color (in alcohol) above saturated uniform "parrot-green;" from the subocular, under the center of the eye, a narrow, strongly defined, pale-yellowish line, the lower row of temporals and across the last supralabial to the side of neck and from there to near the tip of the tail on the middle line of the outer scale row, the lower edge of which is somewhat darker than the rest of the body; underside paler green, washed with blue so as to be almost "beryl-green" toward the sides; tips of tail colored like the rest of the body.

Dimensions.

	mm.
Total length	618
Snout to vent	488
Vent to tip of tail	130

The *female* appears to have a relatively much shorter tail. No. 2a, Science College Museum, measuring 525 mm. in total length, has a tail only 92 mm. long.

Variation.—The Formosan specimens examined by me are very uniform, both in scutellation and coloration, as will be seen from the table at the end, but in individuals from all over the wide range of the species there is displayed a corresponding range of variation. Thus, 19 and 23 scale rows are occasionally, though rarely, recorded; supralabials vary between 8 and 12, ventrals between 145 and 175, subcaudals between 53 and 75 pairs. The color variations consist in more or less distinct blackish dorsal cross bands and the absence of the lateral yellow line. The terminal portion of the tail is frequently yellow or reddish, a color phase which until recently was regarded as a distinct species under the name of *Trimeresurus erythrurus.*

Habitat.—This species is widely distributed from the Himalayas in the north and west, through India, Indo-China, southern China, to the Malayan peninsula, Sumatra, Java, and Timor in the south, and Formosa in the east.

In Formosa it was first collected by Swinhoe, who found it at Takow, no less than seven specimens from him being in British Museum. Both the Hamburg and the Senckenbergian Museum, in Frankfort on the Main, have specimens from south Formosa, the former (No. 1541) through Doctor Warburg, the latter through Schmacker. Mr. Tada, who collected in Formosa for the Japanese Government in 1896 and 1897, brought four specimens from Taihoku (Taipa), and stated that it is common, especially in northern Formosa.

List of specimens of Trimeresurus gramineus.

Museum.	No.	Sex.	Locality.	When collected.	By whom collected.	Scale rows.	Ventrals.	Anal.	Subcaudals.	Interorbitals.	Supralabials.
U.S.N.M....	35516	Male[a] ..	Taipa, Formosa...	1897. Sept. —,	T. Tada......	21	161	1	69	12	10
Sci. Coll., Tokyo.	2*a*	Female[b]	.....do..........	....do.....	.....do.......	21	158	1	68	12	9–10
Do......	2*b*	Male....	.....do..........	....do.....	.....do.......	21	158	1	69	11	10
Do......	2*c*	....do...	.....do..........	....do.....	.....do.......	21	159	1	73	11	9–10
Brit. Mus...	*z*	Male.[c] ..	Formosa........	....	R. Swinhoe ..	21	163	1	67	....	....
Do......	*α*	....do.[c]..	.....do..........	....	.....do.......	21	159	1	71	....	....
Do......	*β*	....do.[c]..	.....do..........	....	.....do.......	21	156	1	68	....	....
Do......	*γ*	....do.[c]..	.....do..........	....	.....do.......	21	162	1	68	....	....
Do......	*δ*	....do.[c]..	.....do..........	....	.....do.......	21	155	1	65	....	....
Do......	*ε*	....do.[c]..	.....do..........	....	.....do.......	21	152	1	66	....	....
Do......	*ζ*	....do.[c]..	.....do..........	....	.....do.......	21	151	1	60	....	....

[a] Description, p. 481.

[b] Figs. 370–372.

[c] Boulenger, Cat. III, p. 556.

Subclass SYNAPSIDA.

1903. *Synapsida* H. F. Osborn, Science (n. s.) XVII, Feb. 13, 1903, p. 276.

Order TESTUDINATA.

1788. *Testudines* Batsch, Anleit. Kenntn. Thiere, Mineral., I (p. 437).
1802. *Chelonia* Macartney in Ross' Transl. Cuvier's Lect. Comp. Anat., I, tab. III.
1804. *Chelonii* Latreille. Nouv. Dict. d' Hist. Nat., XXIV, tabl. méth. p. 61.
1807. *Cataphractæ* Link, Beschr. Nat. Samml. Rostock, II, p. 51.
1811. *Testudinata* Oppel. Ordn. Rept., p. 3.
1814. *Perostia* Rafinesque, Specchio Sci. (Palermo) II, no. 9. 1 Sett., 1814, p. 66.
1822. *Chelonea* Fleming, Philos. Zool., II, p. 268.
1825. *Fornicata* Haworth. Philos. Mag., 1825. (p. 372).
1828. *Sterrichrotes* Ritgen, Nova Acta Acad. Leop. Carol., XIV, p. 269.
1828. *Chelynæ* Wagler, Isis, 1828, p. 861.
1837. *Chelonites* Burmeister, Handb. Naturg., p. 730.
1839. *Chelonides* Swainson, Nat. Hist. Classif. Fish. Amph. Rept., II (Lardner's Cab. Encycl.), p. 112.
1845. *Testudinea* Gravenhorst, Thierwelt, p. 45.
1849. *Tylopoda* Mayer, Rheinland und Westphal. Verhandl., VI (p. 177).

The proper interrelationship between the various types of living Chelonians has not been finally determined as yet. The greatest stumbling block has been the *Dermochelys*, which some authors, such as Baur and Fuerbringer, regard as a highly specialized form more or less closely allied to the other marine turtles, while others have taken the opposite view, regarding it as one of the most primitive types and so radically different from all the other chelonians as to make it expedient to collect the latter in one great suborder and to keep *Dermochelys* by itself in another. The former view is scarcely tenable, if Goette[a] is correct in regarding the bony carapace of the majority of turtles as an integral part of the skeleton as opposed to the dermal origin of the dorsal mosaic of *Dermochelys*. On the other hand, the soft-shelled turtles exhibit so many differences from those with a horny covering that it seems inexpedient to include them in the same category. For these reasons it has been thought best to adhere to the division first proposed by Seeley, in 1882, but to substitute subordinal names for those chosen then by him, these having the form of family names, as understood by most zoologists.

The characters which define the three suborders may be tabulated as follows:

a^1 No solid carapace, the vertebræ and ribs being separated from a shell consisting of a mosaic of numerous small polygonal bony plates imbedded in a leathery skin; no descending process of the parietal bone; limbs without claws. .1. Athecæ, p. 485.

a^2 A solid carapace of a few large symmetrical bony plates not separated from the underlying vertebræ and ribs: parietals with descending processes; limbs with at least one claw each.

  b^1 Body covered with horny scutes arranged differently from the bony plates beneath; epiplastra and hyoplastra in contact, not separated by entoplastron; center of last cervical and first dorsal vertebræ articulating with each other; fourth digit never with more than three phalanges; jaws covered by horny sheaths not concealed under fleshy lips....................2. Laminifera, p. 488.

  b^2 Body covered by an undivided leathery skin without scutes; epiplastra separated by entoplastron from hyo-plastra; last cervical vertebra articulating with first dorsal by zygapophyses only; fourth digit with more than three phalanges; jaws concealed under fleshy lips.......................3. Chilotæ, p. 513.

The turtles occurring within our limits may be easily referred to their respective families by the following:

ARTIFICIAL KEY TO FAMILIES OF TURTLES.

a^1 Limbs clawless; back with five longitudinal keels or ridges (*Athecæ*).
Dermochelidæ, p. 485.

a^2 Limbs with at least one claw each; back, if keeled, with at most three longitudinal ridges.

  b^1 Outer body covering a soft skin without horny plates (*Chilotæ*).
  Trionychidæ, p. 514.

  b^2 Outer body covering consisting of symmetrical horny plates (*Laminifera*).

    c^1 Limbs not paddle-shaped; claws four or five on each limb. .Testudinidæ, p. 488.

    c^2 Limbs paddle-shaped; claws two or one on each limb......Chelonidæ, p. 506.

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[a] Zeitschr. Wissensch. Zool., LXVI, 1899, pp. 407-434.

Suborder ATHECÆ.[a]

1871. *Athecæ* Cope, Proc. Am. Assoc. Adv. Sci., XIX, p. 235.
1880. *Dermatochelyidæ* Seeley, Quart. Journ. Geol. Soc., XXXVI, p. 412.
1889. *Athecata* Lydekker, Cat. Foss. Rept. Brit. Mus., III (p. 223).
1890. *Atheca* Strauch, Mém. Acad. St. Pétersbourg, (7) XXXVIII, No. 2, p. 38.
1891. *Anthecæ* Okada, Cat. Vert. Japan, p. 71 (misprint).

Family DERMOCHELIDÆ.

Limbs paddle-shaped, clawless; shell with five longitudinal dorsal keels and covered with a leathery skin.

The leather-back turtles inhabit the oceans between the Tropics, occasionally straying to temperate coasts. When full grown they reach an enormous size. Only one genus is known.

Genus DERMOCHELYS[b] Blainville.

1816. *Dermochelys* Blainville, Bull. Soc. Philom. Paris, 1816, p. 119 (type, T. *coriacea*).
1820. *Sphargis* Merrem, Syst. Amphib., p. 19 (same type).
1822. *Coriudo* Fleming, Philos. Zool., II (p. 271) (same type).
1828. *Scytina* Wagler, Isis, 1828, p. 861 (substitute for *Sphargis*).
1830. *Dermatochelys* Wagler, Nat. Syst. Amphib., p. 133 (emendation).
1832. *Chelyra* Rafinesque, Atlantic Journ., I, No. 2, p. 64 (type, *T. coriacea*).

DERMOCHELYS SCHLEGELII[c] (Garman).

1835. *Sphargis mercurialis* Temminck and Schlegel, Fauna Japon., Rept., pp. 10 (part), 76, 139, pl. I; pl. II, figs. 3–5; pl. III (Japan) (not of Merrem).—Okada, Cat. Vert. Japan, 1891, p. 71 (Tango).
1850. *Sphargis coriacea* Bleeker Natuurk. Tijds. Nederland. Indië, XV, (p. 260), Padang, Sumatra (not of Linnæus).—Tickel, Journ. Asiat. Soc. Bengal, Nat. Hist., 1862, No. IV, p. 367, pl. — (Tenasserim). McCoy, Nat. Hist. Victoria, II, Dec. XI, 1885, p. 1, pl. CI (Portland, Australia).—*Dermatochelys c.* Guenther, Rept. Brit. India, 1864, p. 55.—*Dermochelys c.* Boulenger, Cat. Chel. Brit. Mus., 1889, p. 10 (part); Fauna Brit. India, Rept. 1890, p. 50.—Burne, Proc. Zool. Soc. London, 1905, I, pp. 291 seqv. (Japan; anatomy).
1884. *Sphargis coriacea* var. *schlegelii* Garman, Bull. U. S. Nat. Mus., No. 25, p. 303 (Tropical Pacific and Indian Oceans).
1884. *Sphargis schlegelii* Garman, Bull. U. S. Nat. Mus., No. 25, p. 295.

Dr. R. A. Philippi has recently described[d] and roughly figured a new species *Sphargis angustata* from the coast of Chile. It is not possible at present to say whether it is identical with *D. schlegelii* or not.

The exact status of this form is not known and no specimen from the Pacific Ocean has come under my observation. Under these circumstances it does not seem necessary to submit any general description of this easily identified, gigantic animal. The young may be found some day in the southern waters adjacent to our territory and may then be referred to their proper place in the system by a comparison with the appended text figures, which are taken from an Atlantic specimen (figs. 373–376).

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[a] From the Greek ἀ, without, and ϑήκη, a closed box.

[b] From δέρμα, skin; χέλυς, turtle.

[c] Named after Dr. Hermann Schlegel. See p. 145.

[d] Anales de Universidad, Mem. Cient. Liter., CII–CIV, Oct. 1899, p. 730.

A specimen was recently captured in Japan and acquired for the Royal College of Surgeons in London, where the skeleton is now preserved. A detailed account of the muscular and visceral anatomy of this specimen has been published recently by Mr. R. H. Burne.

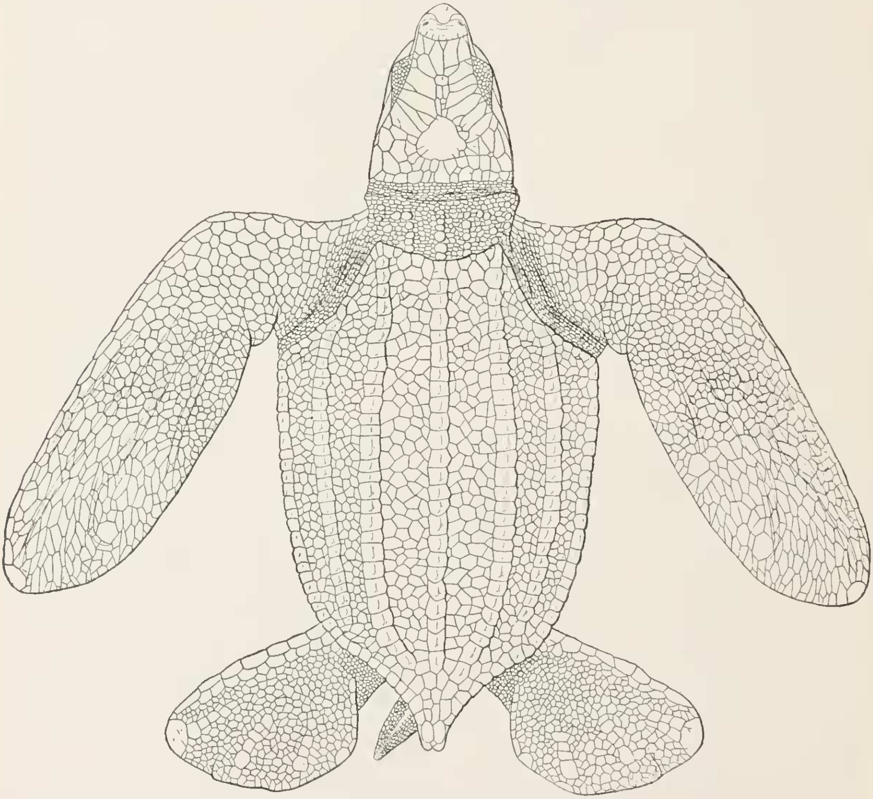


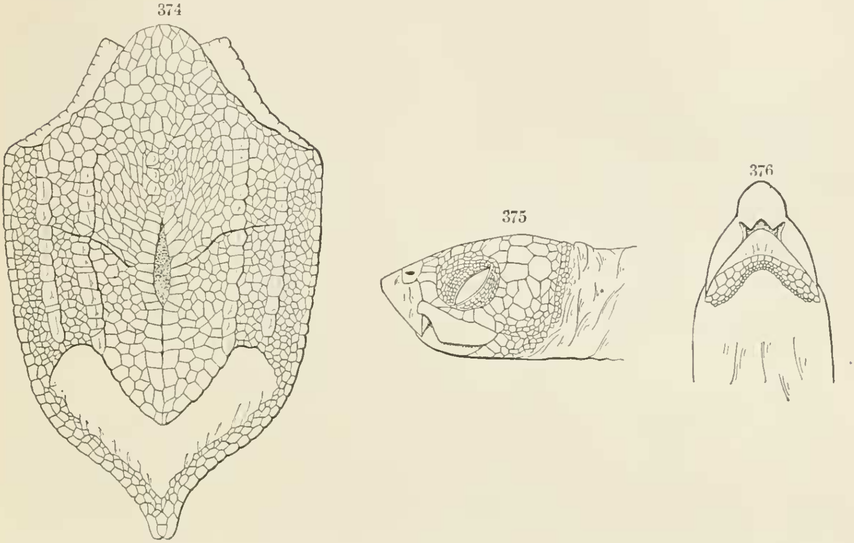
FIG. 373.—DERMOCHELYS CORIACEA, YOUNG. NAT. SIZE. ENTIRE ANIMAL FROM ABOVE. NO. 19796, U.S.N.M.

Mr. Burne gives the following description of some of the external parts of this animal.

Description.—Young female; Museum Roy. College Surgeons, London; Japan.

In color the animal was black above, blotched with irregular white spots, each of which measured on an average 1–2 cm. in diameter. The ventral surface of the body, limbs, and tail was dirty white, marked with irregular longitudinal bands and blotches of black.

The six longitudinal areas into which the carapace is divided by seven bony ridges are apparently of equal breadth—11 cm. in the middle of the trunk—gradually narrowing toward the tail.



Figs. 374-376.—Dermochelys coriacea, young. nat. size. 374, underside of shell; 375, side of head; 376, underside of head. No. 19796, U.S.N.M.

There are six rows of scutes half embedded in the thick plastral integument, a double row along the mid-line, with two single rows about 11 cm. apart on either side.

Dimensions.

	mm.
Total length (following the curve of the carapace)	1,350
Length between the bases of the flippers	680
Girth (under fore limb)	1,350
Girth (midway between the limbs)	1,400
Girth (at base of hind limb)	910
Length of fore limb from its point of emergence from the body (following the outer curve)	820
Greatest breadth of hand	200
Length of hind limb (tibial border)	330
Girth of head at hinder extremity of the gape	530
From point of snout to inner canthus of eye	85
From point of snout to nostril	25

Habitat.—Tropical seas between the east coast of Africa and the west coast of South America, occasionally straggling farther north. Thus von Siebold obtained the specimen, from which the figure in Fauna Japonica is taken, in Japan. In the Imperial Museum, Ueno Park, Tokyo, there is one from the coast of the province of Tango, on the Sea of Japan. A young female was recently acquired by the Royal College of Surgeons, in London, from A. Owston.

Suborder LAMINIFERA.[a]

1820. *Laminifera* Hemprich, Grundr. Naturg., p. 102.
1880. *Aspidochelyidæ* Seeley, Quart. Journ. Geol. Soc., XXXVI, p. 412.
1895. *Cerachelya* Hæckel, Syst. Phylog. Wirbelth., p. .

This suborder, which comprises the *Cryptodira* and *Pleurodira* of Cope and many later authors and which equals Dollo's *Thecophora* minus the soft-shelled turtles, as well as Baur's *Paradiacostoidea* minus the leather-back turtle, is trenchantly characterized by the horny plates which externally cover the shell.

Hemprich, as early as 1820, established the present division as opposed to that of the *Atheeæ* plus *Chilotæ*, which he designated collectively as *Coriacea*.[b]

The horny-shelled turtles belong to two different superfamilies, the *Testudinoideæ*, corresponding to the group *Cryptodira*, and the *Chelydoideæ*, equaling the *Pleurodira*, but only members of the former enter our limits, as at the present day the latter are confined to the southern hemisphere. Of the numerous families composing the *Testudinoideæ* only two are intralimital, viz, the marine turtles, with paddle-shaped limbs having less than three claws, and the subfamily *Emydinæ* of the family *Testudinidæ*, having normal limbs with more than two claws.

Family TESTUDINIDÆ.

Subfamily EMYDINÆ.

Web-footed turtles having the nuchal plate without costiform lateral processes.

The terrapins constitute the bulk of the species and genera of turtles, widely distributed in the temperate and tropical countries. They live in streams, lagoons, or on land, and are both vegetable and animal feeders. Some species are highly esteemed as delicacies.

SYNOPSIS OF THE EMYDINE GENERA OCCURRING IN JAPAN, FORMOSA, AND KOREA.

a^1 Plastron not hinged; plastron and carapace joined by suture.
  b^1 Triturating surface of upper jaw with a longitudinal median ridge..*Ocadia*, p. 489.
  b^2 Triturating surface of upper jaw without a median ridge.
    c^1 Choanæ behind level of eyes; skin of hinder part of head divided into small shields..*Geoclemys*, p. 496.
    c^2 Choanæ between the eyes; upper surface of head with undivided skin.
      d^1 Hexagonal neural plates with the anterior lateral edge shorter than the posterior lateral edge..................................*Clemmys*, p. 492.
      d^2 Some of the hexagonal neural plates with the anterior lateral edge longer than the posterior lateral edge................................*Geoemyda*, p. 500.
a^2 Plastron hinged; plastron and carapace joined directly by ligament..*Cyclemys*, p. 503.

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[a] From *lamina*, a thin plate [of horn, in this case], and *fero*, I bear.

[b] Grundr. Naturg., 1820, p. 101.

Each of these genera is represented in the territory here included by a single species only, which may be more conveniently identified by the following:

ARTIFICIAL KEY.

- a^1 Plastron emarginate behind.
  - b^1 Axillary and inguinal shields present; upper jaw not hooked.
    - c^1 Whole top of head smooth.
      - d^1 Sides of head with numerous narrow longitudinal yellowish stripes; plastron yellow, each shield with a large brown blotch....... *Ocadia sinensis*, p. 489.
      - d^2 Head nearly uniformly colored: plastron mainly black. *Clemmys japonica*, p. 492.
    - c^2 Posterior half of top of head with skin divided into small shields. *Geoclemys reevesii*, p. 497.
  - b^2 No inguinal shield; upper jaw strongly hooked ...... *Geoemyda spengleri*, p. 501.
- a^2 Plastron rounded behind .... *Cyclemys flavomarginata*, p. 503.

Genus OCADIA [a] Gray.

1870. *Ocadia* GRAY, Suppl. Cat. Shield Rept. Brit. Mus., I, p. 35 (type, *Emys sinensis*).

Only a single species of this genus is known.

OCADIA SINENSIS Gray.

Plate XXVIII.

1834. *Emys sinensis* GRAY, Proc. Zool. Soc. London, 1834, p. 53 (type-locality, southern China; type in Brit. Mus.; J. Reeves, collector); Cat. Shield Rept. Brit. Mus., I, 1855, p. 21, pl. VII (Canton, China).—SWINHOE, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 219 (Taiwan fu, Formosa).—GUENTHER, Rept. Brit. India, 1864, p. 27 (south Formosa).—*Ocadia sinensis* GRAY, Suppl. Cat. Shield Rept. Brit. Mus., I, 1870, p. 35; Proc. Zool. Soc. London, 1873, p. 192 (skull, figure).—BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 85 (Canton; Formosa).—BOETTGER, Kat. Rept. Mus. Senckenberg., I, 1893, p. 4 (Takao, Formosa).—STEJNEGER, Journ. Sci. Coll. Tokyo, XII, Pt. 3, 1898, p. 225 (Taipa, Formosa).

1844. *Emys bennettii* GRAY, Cat. Tortois. Brit. Mus., p. 21 (type-locality "North America?"; type in Brit. Mus.); Cat. Shield Rept. Brit. Mus., I, 1855, p. 22, pl. X [b] (China?); Proc. Zool. Soc. London, 1863, p. 176 (identity with *E. sinensis*).—SCLATER, Proc. Zool. Soc. London, 1862, p. 151

1870. *Emys chinensis* GRAY, Suppl. Cat. Shield Rept. Brit. Mus., I, p. 28 (emended name).

Description.—Young, probably second year; Science College Museum, Tokyo, No. 29; Taipa, Formosa; September, 1896; T. Tada, collector (figs. 377–381). Snout conical, projecting, vertical profile oblique, straight; edges of jaws not denticulated, upper jaw without median or lateral hooks, distinctly notched mesially; triturating surface of upper jaw with a longitudinal ridge near the inner edge; mandibular symphysis less than length of eye slit; skin on entire top of head smooth; body rather depressed, the depth being but slightly more than half the width of the carapace; carapace with three keels, a median, continuous, broad, prominent, and one on each side consisting of four narrow, low keels, one on each costal, in a discontinuous series inasmuch as being placed obliquely across the costal shields the posterior end of each keel extends externally beyond the anterior end of the one following; nuchal broader than long; first vertebral squarish, somewhat broader in front than behind; all vertebrals broader than long, about as broad as the adjacent costals; margin slightly turned up, not serrated behind, though the posterior corner of each marginal extends slightly beyond the one following; eighth and ninth marginals broadest; plastron flat, emarginate behind sharply bent at the bridge, truncate anteriorly; posterior lobe as long as the width of the bridge, narrower than the shell; abdominal seam longest, equaling gular and humeral seams together, the latter being the shortest; pectoral seam as much longer than the femoral seam as the latter is longer than the anal seam; inguinal shield twice as large as axillary; toes webbed to the tips; tail long, a little more than one-half the length of the carapace, tapering to a point.

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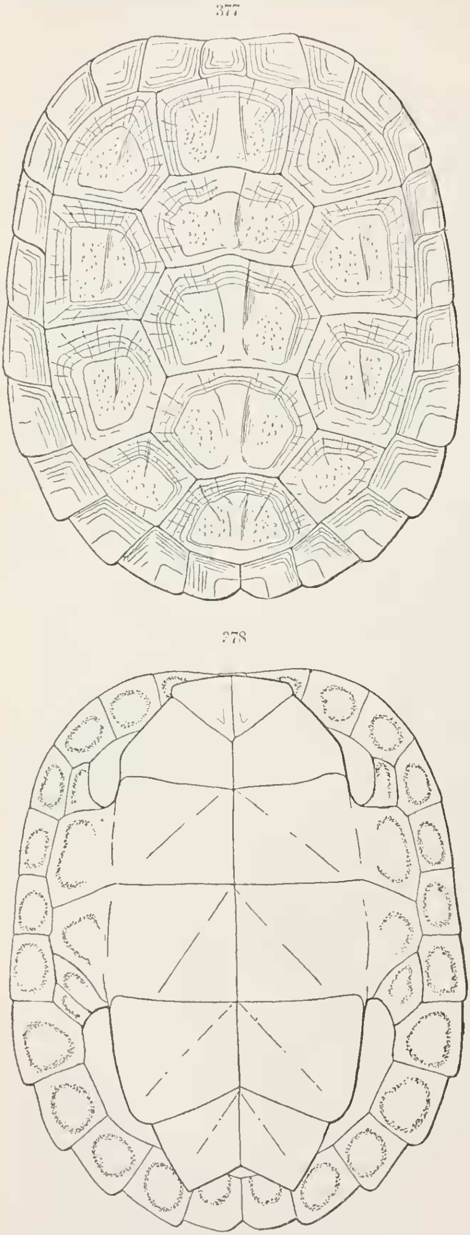
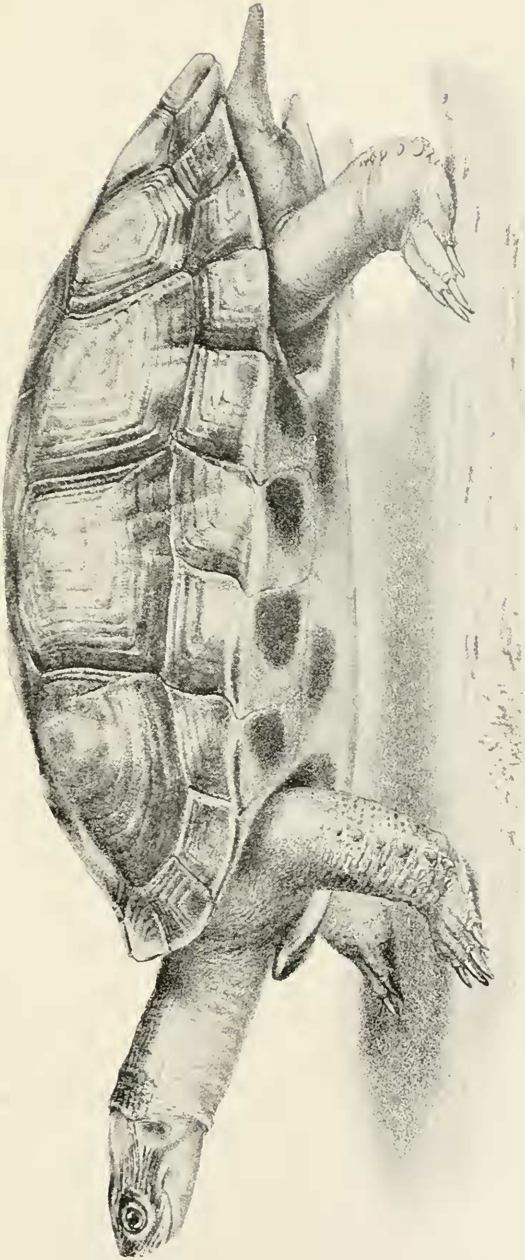
[a] A coined word without meaning.

[b] Lower figure reproduced in this work on Plate XXVIII.



Figs. 377-378.—Ocadia sinensis. nat. size. 377, carapace; 378, plastron. No. 29, Sci. Coll. Tokyo.

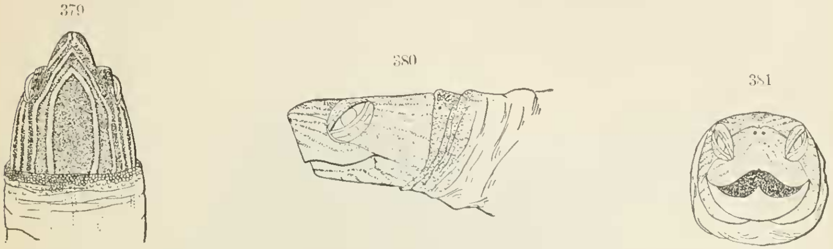
Color (in alcohol): Carapace raw umber, each shield with a large, polygonal, excentric, well-defined reddish brown spot; each marginal



OCADIA SINENSIS. (FROM GRAY.)

FOR EXPLANATION OF PLATE SEE PAGE 556.

anteriorly narrowly edged with bright yellow; underside of shell ocher yellow, each shield with a large reddish brown blotch at the outer posterior corner, each marginal and each shield on bridge with a narrow circle of dark brown, the reddish brown blotches being placed excentrically to this ring; crown uniform olive-brown, the rest of head and neck olive, with narrow longitudinal black-edged, pale yellow stripes between pale olive stripes of nearly the same width; legs, feet, and tail similarly striped.



Figs. 379–381.—Ocadia sinensis. 1⅓ × nat. size. 379, top of head; 380, side of head; 381, head from front. No. 29, Sci. Coll. Tokyo.

Dimensions.

	mm.
Greatest length of carapace	73
Greatest width of carapace	58
Greatest length of plastron	66
Length of hind lobe of plastron	24
Width of hind lobe of plastron	32
Width of opening of shell posteriorly	38
Width of bridge	24
Depth of shell	31
Width of head	12
Length of tail from vent	38

The *adults* are said to have shorter tails, the females shorter than the males. In very young specimens the tail is said to be about two-thirds the length of the shell. The lateral keels usually disappear in the adults, according to Boulenger, who records an adult specimen with a length of shell of 230 mm.

Variation.—The edges of both jaws are described by Boulenger as finely denticulated, and the pectoral seam as equaling or exceeding the gular and humeral seams together; nuchal may be longer than broad, and second and third vertebrals may be as long as broad.

Habitat.—The present species seems to be restricted to southern China and the island of Formosa. On the latter it has been recorded both from the northern and from the southern part. Swinhoe had it from Taiwan fu and the Senckenberg Museum has it from Takao, while I have examined a specimen from Taipa, and Mr. Tada notes it as common in the Tamsui River, though he may possibly have confounded it with *Cyclemys flavomarginata*.

List of specimens of Ocadia sinensis.

Museum.	No.	Age.	Locality.	When collected.	By whom collected.
Sci. Coll. Tokyo....	29	Young[a]....	Taipa, Formosa....	Sept. —, 1896	T. Tada.

[a] Description, p. 489; figs. 377–381.

Genus CLEMMYS[a] Ritgen.

1828. *Clemmys* RITGEN, Nova Acta Acad. Leop. Carol., XIV, Pt. 1, p. 272 (type, *Emys punctata*).
1832. *Chelopus* RAFINESQUE, Atlantic Journ., I, no. 2, p. 64 (same type).
1857. *Nanemys* AGASSIZ, Contr. Nat. Hist. U. S., I, p. 442 (same type).
1857. *Calemys* AGASSIZ, Contr. Nat. Hist. U. S., I, p. 443 (type, *C. muhlenbergii*).
1857. *Glyptemys* AGASSIZ, Contr. Nat. Hist. U. S., I, p. 443 (type, *G. insculpta*).
1857. *Actinemys* AGASSIZ, Contr. Nat. Hist. U. S., I, p. 444 (type, *A. marmorata*).
1869. *Mauremys* GRAY, Proc. Zool. Soc. London, 1869 (p. 499) (type, *M. lanaria*).
1870. *Geoclemmys* GRAY, Suppl. Cat. Shield Rept. Brit. Mus., p. 26 (type, *G. guttata*; not of 1855).
1870. *Socalia* GRAY, Suppl. Cat. Shield Rept. Brit. Mus., p. 35 (type, *S. bealii*).
1870. *Emmenia* GRAY, Suppl. Cat. Shield Rept. Brit. Mus., p. 38 (type, *E. grayi*).
1870. *Eryma* GRAY, Suppl. Cat. Shield Rept. Brit. Mus., p. 44 (type, *E. laticeps*).

CLEMMYS JAPONICA (Temminck and Schlegel).

ISHIGAME.

Plate XXIX.

1835. *Emys vulgaris* TEMMINCK and SCHLEGEL, Fauna Japon., Rept., p. 53 (Japan) (not of Gray 1831).
1835. *Emys vulgaris japonica* TEMMINCK and SCHLEGEL, Fauna Japon., Rept., p. 139 (Japan).—SCHLEGEL, Abbild. Amph., 1840, p. 126, pl. XII.
1835. *Emys palustris* var. *japon[ica]* TEMMINCK and SCHLEGEL, Fauna Japon., Rept., pl. VIII, figs. 1–4;[b] pl. IX.
1844. *Emys japonica* GRAY, Cat. Tortois. Brit. Mus., p. 19 (Japan); Proc. Zool. Soc. London, 1869, p. 190 (Japan).—OKADA, Cat. Vert. Japan, 1891, p. 71 (Awaji; Bingo; Suwa; Chikuzen).—*Clemmys japonica* STRAUCH, Chelon. Studien, 1862 (p. 32); Mém. Acad. Sci. St. Pétersb. (7), XXXVIII, no. 2, 1890, p. 70 (Tsu-shima; Hondo).—HILGENDORF, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 111 (Tokyo).—BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 106 (Kobe; Yokohama).—BOETTGER, Kat. Rept. Mus. Senckenberg., I, 1893, p. 5 (Tokyo).
1851. *Emys caspica* var. DUMÉRIL, Cat. Méth. Rept. Mus. Paris, p. 8 (Japan).
1852. *Emys caspica* var. *japonica* DUMÉRIL, Arch. Mus. Paris, VI, p. 219.
1878. *Cistudo lutaria* BOETTGER, Offenbach. Ver. Naturk. 17 and 18 Ber., p. 8 (Japan) (not of Linnæus, Bell, nor Schneider).

Judging from the above synonymy one might suppose that the Japanese *Clemmys* is a particularly close ally to one or both of the west-palearctic species, since it has been described as a variety of *Emys vulgaris* by Temminck and Schlegel, and as a variety of *E. caspica* by Duméril. This is not so, however, and the only character which points in that direction is the short anal seam, a character

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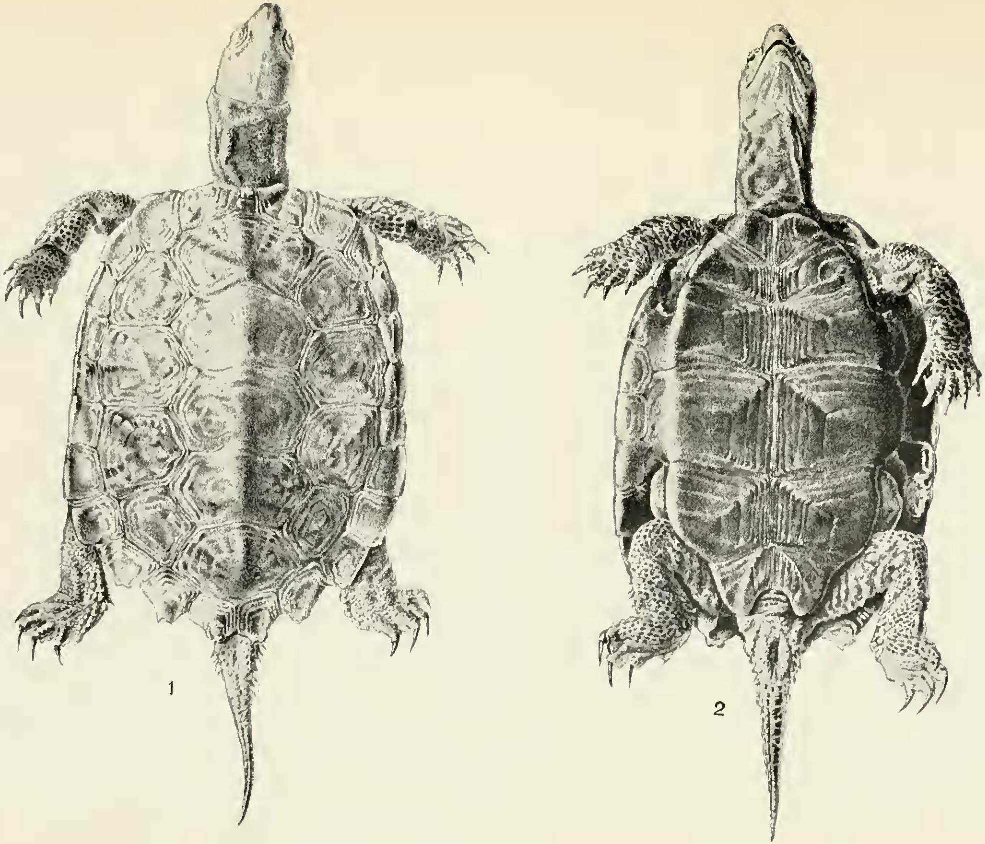
[a] From κλέμμυς, turtle.

[b] Figs. 2–3 reproduced in this work on Plate XXIX.

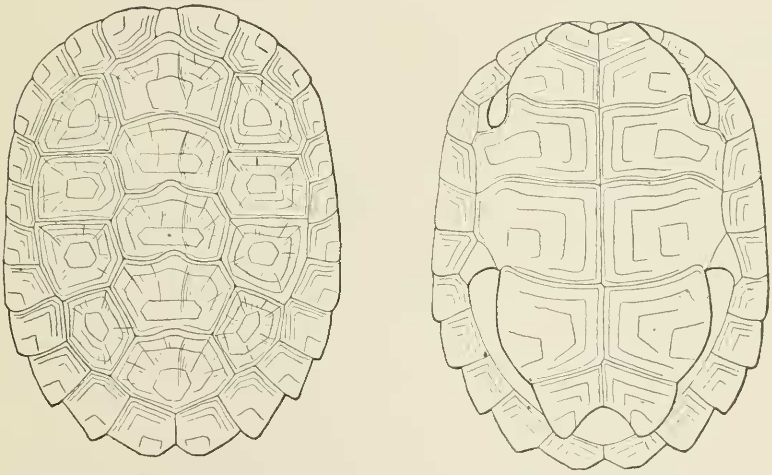


Clemmys japonica. (From Schlegel.)

For explanation of plate see page 556.

which is not constant, as shown later on. Nor does it appear to be very closely allied to any of the other species of *Clemmys* known with certainty to occur on the Chinese mainland, viz, *C. bealii* and *C. nigricans*. Its nearest relative seems to be *C. schmackeri*, described not long ago by Doctor Boettger from a young specimen, the locality of which is given as "China, probably Hainan." It is permissible to suggest that this species may occur in various parts of southern China, and that the unconnected position of *C. japonica*, so curious in view of the close relationship of the other two Japanese turtles, *Amyda japonica* and *Geoclemys reevesii*, may be more apparent than real.

Clemmys japonica and *Ocadia sinensis* are very easily told apart by color alone as indicated in the "key" above (p. 489), but in general proportions, relations of shields, etc., they show many similarities, although a more close examination of details will reveal a great number of important differences. Apart from the difference in the triturating surface of the upper jaw, with a longitudinal ridge in the latter and without one in the former, *C. japonica* has no median notch to the edge of the upper jaw; its shell is more depressed and the hind lobe of the plastron relatively broader; the posterior outline of the carapace is also strongly serrated.



FIGS. 382-383.—CLEMMYS JAPONICA. ⅔ NAT. SIZE. 382, CARAPACE; 383, PLASTRON. NO. 23522, U.S.N.M.

Description (figs. 382–383).—*Female, third year;* U.S.N.M., No. 34066; Tokyo; February 23, 1904; A. Owston collection. Snout but slightly projecting, vertical profile slightly oblique, straight; edges of jaws not denticulated, upper jaw without hooks or median notch; triturating surface of upper jaw narrow without any longitudinal ridge; mandibular symphysis nearly equaling length of eye slit; skin on entire top of head smooth; body rather depressed, the depth being considerably less than half the length of carapace and but slightly more than half its width; carapace with a single, median, undulating keel; shields with deeply cut concentric lines toward the border, the vertebrals and costals with well-marked bosses from which issue radiating lines; nuchal rather large, almost as broad as long; first vertebral slightly wider than the others, which are as broad as or broader than the adjacent costals, and all much broader than long; edge of marginals from third to eighth turned up, behind the latter each marginal extending considerably beyond the next with its posterior corner, so that the outline is strongly serrate; eighth and ninth marginals broadest; plastron flat, angularly notched behind, obtusely emarginate in front, bridge angle gently rounded, each shield with deeply cut parallel lines mostly along the anterior and interior margins; posterior lobe fully as long as the bridge, as wide as the opening of the shell; abdominal seam much the longest, longer than that of humerals and gulars together, femoral seam longer than anal; inguinal shield somewhat larger than axillary; toes webbed to the tips; tail rather long, more than one-third the length of the carapace, tip rather blunt, base studded with numerous high conical tubercles or blunt spines. Color (in alcohol): Carapace tawny-olive, obscurely spotted with dusky; dorsal keel burnt umber, this color spreading sidewise on the transverse seams of the vertebrals; costals paler buff toward the outer margin, the dusky or blackish maculations being more distinct on this pale belt; underside uniformly black; head above uniform olive; a narrow black line from nostril to eye, and a narrow, pale, black-edged supratemporal band from the posterior corner of eye; neck olive gray with numerous raised, slightly tuberculated longitudinal ridges which appear to be paler; legs and feet blackish, with a pale band along the inner edge of forearm and tibia; tail with obscure, pale, longitudinal bands, one on each side of the median line.

Dimensions.

	mm.
Greatest length of carapace	124
Greatest width of carapace	88
Greatest length of plastron	117
Length of hind lobe of plastron	45
Width of hind lobe of plastron	60
Width of bridge	42
Depth of shell	47
Width of head	19
Length of tail from vent	45

The *adult* is more elongate in proportion to width and depth than the one described above. The *male* differs but slightly from the female, the plastron being scarcely concave, but the hind lobe of the plastron is slightly narrower and the depth of the shell somewhat less. The recently hatched *young* (No. 23526, fig. 384) is nearly circular, with relatively much longer tail than the older ones, and the posterior marginals are notched externally so as to make the outline exceedingly serrate; the nuchal is usually notched; and the gulars are truncate anteriorly, each with a lateral notch. The proportions at various ages can be seen from the measurements in the table of specimens at the end of this article. The young of the first year differ also in color, being isabella-colored above with very faint dusky maculations and reticulations and pale outer edges to the marginals; the plastron is more or less uniform blackish brown with pale edges and the marginals are pale with dusky markings on the seams; the pale longitudinal stripes on neck and legs are more distinct than later.

Variation.—The relative proportions of the various shields and their seams are subject to some variation. The most important, perhaps, is that of the femoral and anal seams, as the proportion of these has been used as an important character in distinguishing the various species of this genus. In most specimens of *C. japonica* the femoral seam is longer, often much longer than the anal, but in our only very large specimen (U.S.N.M. No. 9551) the anal seam is 27 mm. and the femoral only 23 mm., consequently not less than 4 mm. shorter than the former. The variations in color are neither considerable nor important. Often the posterior corner of the anal shields is pale or whitish, the pattern on the carapace more or less distinct, the stripes on side of head more or less obliterated or in some specimens more emphasized than described above. One of our specimens (No. 34067) has a pale black-edged stripe on the upper lip at the angle of the mouth and a similar parallel stripe on the lower jaw.

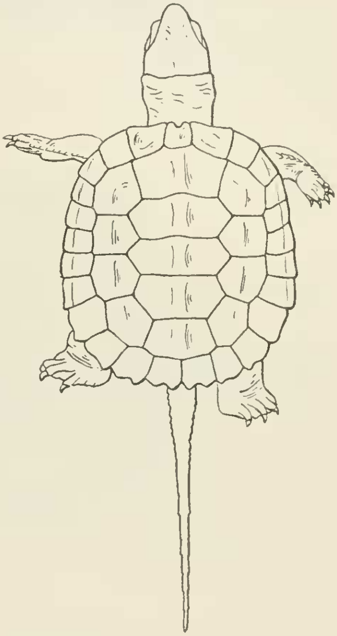


FIG. 384.—CLEMMYS JAPONICA. YOUNG. NAT. SIZE. NO. 23526, U.S.N.M.

Habitat.—Confined to Japan, so far as known.

Published records show that it occurs as far north at least as Tokyo. Specimens from the neighborhood of this city and Yokohama are in various museums. British Museum has a specimen from Kobe and I have seen one from Kagoshima, Satsuma, in Kiusiu. Doctor Lenz, in 1896, collected it in the provinces of Setsu, Kii, and Bizen (Hamburg Mus. Nos. 184, 186, 187), and Okada records it from the provinces of Awaji, Bingo, Suwa, and Chikuzen. The Academy of Sciences in St. Petersburg has it from Tsushima.

List of specimens of Clemmys japonica.

U.S. N.M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Length of carapace.	Width of carapace.	Length of plastron.	Width of hind lobe.	Width of bridge.	Depth of shell.	Tail from vent.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*
9551	Female [a]	Japan		E. S. Morse	182	128	175	103	68	73	69
23522	Young [b]	Yokohama	1896. Oct.	L. Stejneger							
23523	do. [c]	do	do	do							
23524	do. [c]	do	do	do							
23525	do. [c]	do	do	do							
23526	do. [d]	do	do	do	35	31	29	16	9	14	32
23527	do [c]	do	do	do							
34066	Female [e]	Tokyo	1904. Feb. 23	A. Owston	124	88	117	60	42	47	45
34067	Male [f]	do	do	do							
34068	do. [f]	do	do	do	112	81	100	53	35	40	31
34069	Young [g]	do	do	do							
34070	do. [g]	do	do	do							
34071	do. [g]	do	do	do	87	66	80	41	29	33	34
34072	do. [g]	do	do	do							
34073	do. [g]	do	do	do							
34074	do. [g]	do	do	do							
34075	do. [g]	do	do	do							

[a] P. 495.
[b] Second year; figs. 382-383.
[c] Recently hatched.
[d] Recently hatched; fig. 384.
[e] Third year; description, p. 493.
[f] Third year.
[g] Second year.

Genus GEOCLEMYS[a] Gray.

1855. *Geoclemys* Gray, Cat. Shield Rept. Brit. Mus., 1855, p. 17 (type, *G. hamiltonii*).

1869. *Damonia* Gray, Proc. Zool. Soc. London, 1869, p. 193 (type, *D. macrocephala*=*G. subtrijuga*).

In his Catalogue of Shielded Reptiles (1855) Gray first established the genus *Geoclemys* for the following species, without indicating a type:

G. hamiltonii.	*G. seba.*	*G. muhlenbergii.*
G. reevesii.	*G. pulchella.*	*G. guttata.*

Two years later Agassiz[b] made each of the last three species a type of separate genera, respectively *Glyptemys*, *Calemys*, and *Nanemys*.

G. seba is a synonym of *Emys trijuga* Gray (1855) which he himself in 1869[c] made the type of his new genus *Melanochelys*.

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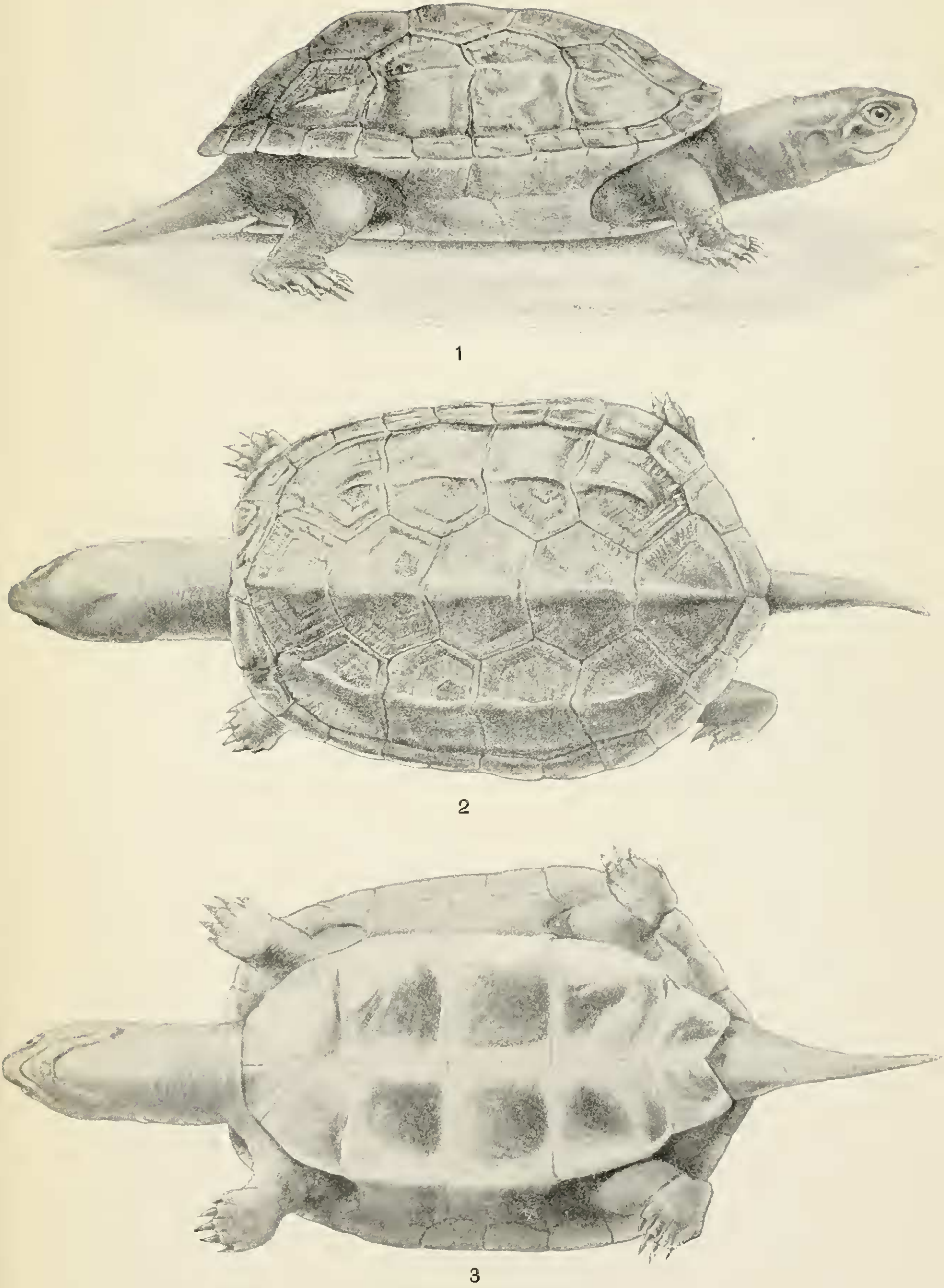
[a] From γῆ, earth, land; and *clemys*, erroneous for κλεμμυς, a turtle.
[b] Contr. Nat. Hist. U. S., I, 1857.
[c] Proc. Zool. Soc. London, 1869, p. 187.



GEOCLEMYS REEVESII. (FROM GRAY.)

FOR EXPLANATION OF PLATE SEE PAGE 556.

This leaves only the species *G. hamiltonii* and *G. reevesii* in the genus *Geoclemys,* and both being strictly congeneric it matters not which one we select as the type. It is, consequently, quite irrelevant that Gray himself in 1869 [a] included these in his new genus *Damonia.* As the latter only includes species congeneric with *G. hamiltonii* and *reevesii,* it becomes a synonym of Gray's *Geoclemys* of 1855. His *Geoclemmys* of 1869, as he then spelt it, on the other hand becomes a synonym of *Clemmys.*

GEOCLEMYS REEVESII [b] (Gray).

Plate XXX.

1831. *Emys reevesii* Gray, Synops. Rept., p. 73 (type-locality China; types in Brit. Mus.; J. Reeves, jr., collector).—Ruetimeyer, Verh. Naturf. Ges. Basel, VI, Pt. I, 1873. p. 48 (Japan). *Geoclemys reevesii* Gray, Cat. Shield Rept. Brit. Mus., I, 1855, p. 18, pl. v [c] (China).—*Damonia reevesii* Gray, Proc. Zool. Soc. London, 1869, p. 194.—Boulenger, Cat. Chel. Brit. Mus., 1889, p. 95 (China; Japan).—Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, 1904, p. 353 (Shanghai and Hankow, China).—*Clemmys v.* Strauch, Chenol. Stud., 1862 (p. 104); Mém. Acad. Sci. St. Pétersb. (7), XXXVIII, No. 2; 1890, p. 74 (China; Chemulpo, Korea).—Sclater, Proc. Zool. Soc. London, 1873, p. 517 (Ningpo).

1840. *Emys vulgaris picta* Schlegel, Abbild. Amph., p. 127, pl. xlii (type-locality, Japan; types in Leiden Mus.; Buerger, collector) (not *E. picta* of Schweigger).

1851. *Emys japonica* Duméril, Cat. Méth. Rept. Mus. Paris, I, p. 8 (Japan); Arch. Mus. Paris, VI, 1852, p. 220 (not *E. vulgaris japonica* of Schlegel).

1873. *Damonia unicolor* Gray, Ann. Mag. Nat. Hist. (4), XII (p. 78)(type-locality, Shanghai, China; types in Brit. Mus.; R. Swinhoe, collector).—*Clemmys unicolor* Sclater, Proc. Zool. Soc. London, 1873, p. 517, pl. xliv (correct type-locality, Ningpo).—Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 111 (Japan).

1889. *Damonia reevesii* var. *unicolor* Boulenger, Cat. Chel. Brit. Mus., p. 96 (Shanghai: [probably Ningpo, Sclater, Proc. Zool. Soc. London, 1873, p. 577]).—Werner, Abh. Bayer. Akad. Wiss. (Muenchen), II Klasse, XXII, Pt. 2, p. 353 (Hankow ,China).

1891. *Emys ? sinensis* Okada, Cat. Vert. Japan, p. 72 (Osaka) (not of Gray).

Description.—Male; U.S.N.M. No. 21181; Seoul, Korea; August, 1883; P. L. Jouy, collector (figs. 385–388). Snout rather pointed, strongly projecting, vertical profile oblique; edges of jaws not denticulated, upper jaw without hooks or median notch; triturating surface of upper jaw broad, without any longitudinal ridge; mandibular symphysis slightly longer than eye slit; anterior part of head covered by a large smooth shield on crown and snout, another on each side covering the whole temporal region, and the usual rostro-labial shield; parietal and auricular regions covered by small polygonal shields, most of those on the former with a central rounded tubercle; body moderately depressed, its depth being less than half the length, but considerably more than half the width of the carapace; carapace with nearly parallel sides, and three strong keels; shields with deeply cut concentric lines, radiating lines also fairly strong; nuchal small, narrower in front, emarginate behind, as long as broad; first vertebral pentagonal, broader in front than behind, not broader than the others which are of subequal width and of the same width as the anterior three costals; edge of marginals from third to eighth turned up; posterior marginals not projecting their corners so that the posterior outline of the shell is nearly even, not serrated; ninth marginal broad-

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[a] Proc. Zool. Soc. London, 1869, p. 193.

[b] For Mr. John Russell Reeves, jr., who collected the type.

[c] Reproduced in this work on Plate XXX.

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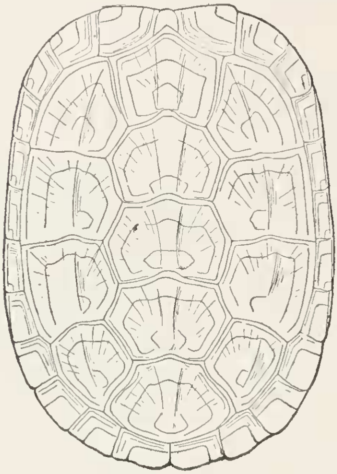

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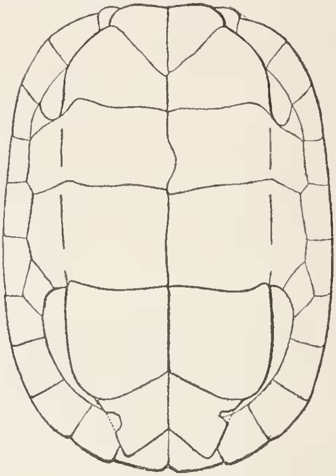

Figs. 385-386.—Geoclemys reevesii. ½ × nat. size. 385, carapace; 386, plastron. No. 21181, U.S.N.M.

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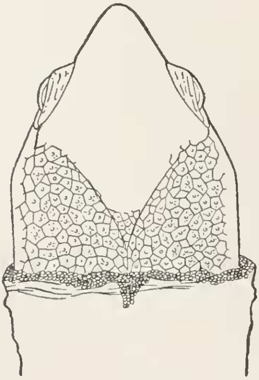

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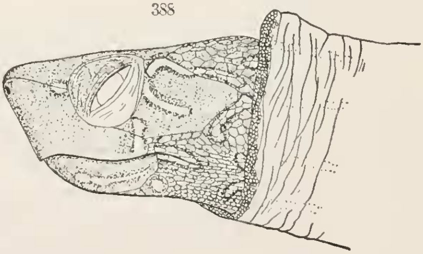

Figs. 387-388.—Geoclemys reevesii. 1⅓ × nat. size. 387, top of head; 388, side of head. No. 21181, U.S.N.M.

est; plastron very slightly concave, angularly notched behind, truncate in front, bridge angle rounded, shields nearly smooth; posterior lobe slightly longer than bridge, nearly as wide as opening of the shell; abdominal seam longest, but only slightly longer than femoral, less than humeral and gular together; femoral longer than pectoral; gular seam longer than anal, humeral shortest; inguinal shield larger than axillary; toes webbed to the tips; tail tapering, somewhat compressed at tip. Color (in alcohol): Carapace chestnut brown, the median keel blackish brown; a small darker brown pentagonal spot on the areola of each costal above the lateral keel; vertebrals and transverse edges of costals narrowly outlined with yellow; shields of underside blackish brown with all seams and outer edge of hind lobe of plastron edged with buff, the median seams broadly so; head, neck, and limbs tawny olive; a number of yellow, black-edged stripes and vermiculations on side of head, the principal being supratemporal line; a medio-temporal line; a preauricular line; a line posteriorly on both lips and surrounding the angle of mouth; a small spot in front of eye; several irregular lines and spots on lower jaw; neck with numerous longitudinal lines of ocellated, dull buff spots; limbs and tail without distinct markings, though on underside of thigh there are indications of lines of spots similar to those on neck.

Dimensions.

	mm.
Greatest length of carapace	122
Greatest width of carapace	87
Greatest length of plastron	119
Length of hind lobe of plastron	44
Width of hind lobe of plastron	53
Width of bridge	42
Depth of shell	53
Width of head	21
Length of tail from vent	37

Variation.—The specimens examined by me offer but very insignificant variations in structure as well as in coloration. The latter, however, is not constant, and specimens, more or less uniform black, occur both in China, where they have given rise to "*Damonia unicolor*," and in Japan. The specimens from the latter country, which Schlegel described as *Emys vulgaris picta* seem to belong to this color variety, but the yellowish marks on side of head and neck were very conspicuous. That perfectly uniform black ones occur in Japan also seems certain from Hilgendorf's notes on a specimen of "*Clemys unicolor*," which he purchased alive in Tokyo, and which had "neck and head . . . plain dusky without any kind of markings."

Habitat.—Eastern and southern China, Korea, and southern Japan. In China it is known from Tientsin to Canton and in the interior at least as far as Hankow. It is also reported from Cochin China.

Its occurrence in Korea was first recorded by Strauch from a specimen collected by Doctor Bunge at Chemulpo in 1890 and now in the museum of the St. Petersburg Academy (No. 7907). Two other specimens from Korea, only one of which has a definite locality, are in our museum collected by Jouy and Bernadou, respectively.

In Japan it seems to be rare and is probably restricted to the southern part. It was the first addition to the herpetological fauna of the country after the publication of the Fauna Japonica, and was made public by Schlegel himself (as *Emys vulgaris picta*) from three specimens collected by Mr. Buerger, probably in Kiusiu. Since then but few Japanese specimens have been recorded, mostly without definite localities. I myself have only examined one from Kagoshima, Satsuma, in Kiusiu. In the Hamburg Museum there are several specimens collected by Doctor Lenz, in 1896, in the province of Setsu, Hondo (No. 188). Okada records a turtle from Osaka as *Emys? sinensis* which probably is the present species. British Museum has it from Tsushima collected by Holst.

List of specimens of Geoclemys reevesii.

U.S.N.M. No.	Sex and age.	Locality.	When collected.	By whom collected.	Length of carapace.	Width of carapace.	Length of plastron.	Width of hind lobe.	Width of bridge.	Depth of shell.	Tail, from vent.
					mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*
14512	Male	Korea		J. B. Bernadou	101	73	93	41	34	43	30
21181	do.[a]	Seoul, Korea	1883. Aug. —	P. L. Jouy	122	87	119	53	42	53	37
21249	Young[b]	(Bering Island)	1891. Sept. —	N. A. Grebnitski							

[a] Description, p. 497; figs. 385-388.

[b] Thrown out by the sea.

Genus GEOEMYDA[a] Gray.

1834. *Geoemyda* Gray, Proc. Zool. Soc. London, 1834, p. 100 (type, *Testudo spengleri*).
1836. *Geoemys* Bonaparte, Chelon. Tab. Anal., p. 6 (emendation; same type).
1855. *Nicoria* Gray, Cat. Shield Rept. Brit. Mus., I, p. 17 (same type).
1869. *Melanochelys* Gray, Proc. Zool. Soc. London, 1869, p. 187 (type, *M. trijuga*).
1876. *Chaibassia* Theobald, Cat. Rept. Brit. India (p. 6) (type, *Ch. tricarinata*).

The reason for adopting the name *Geoemyda* instead of *Nicoria* for the present genus is the fact that *G. spengleri* was specifically designated as the type when the genus was first established as demonstrated by me in detail on a former occasion.[b]

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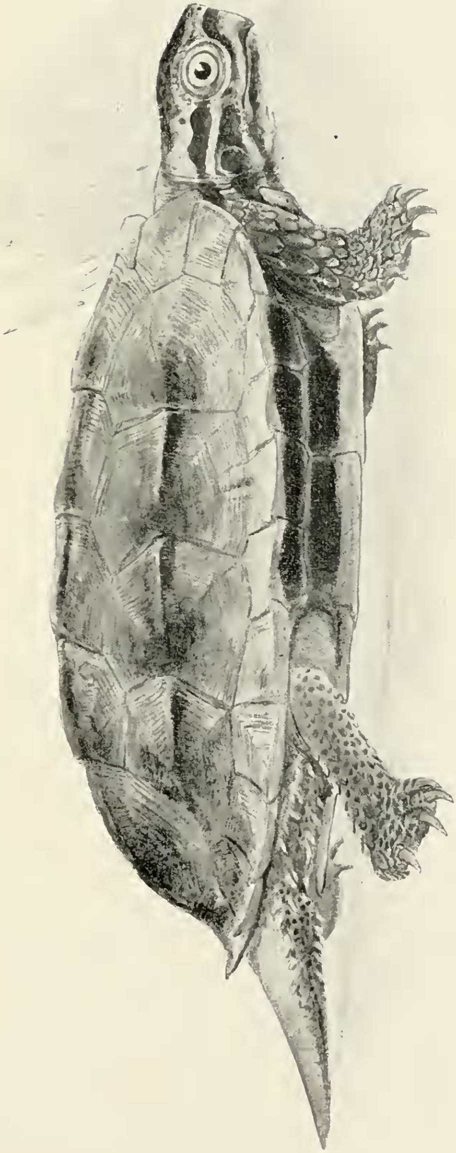
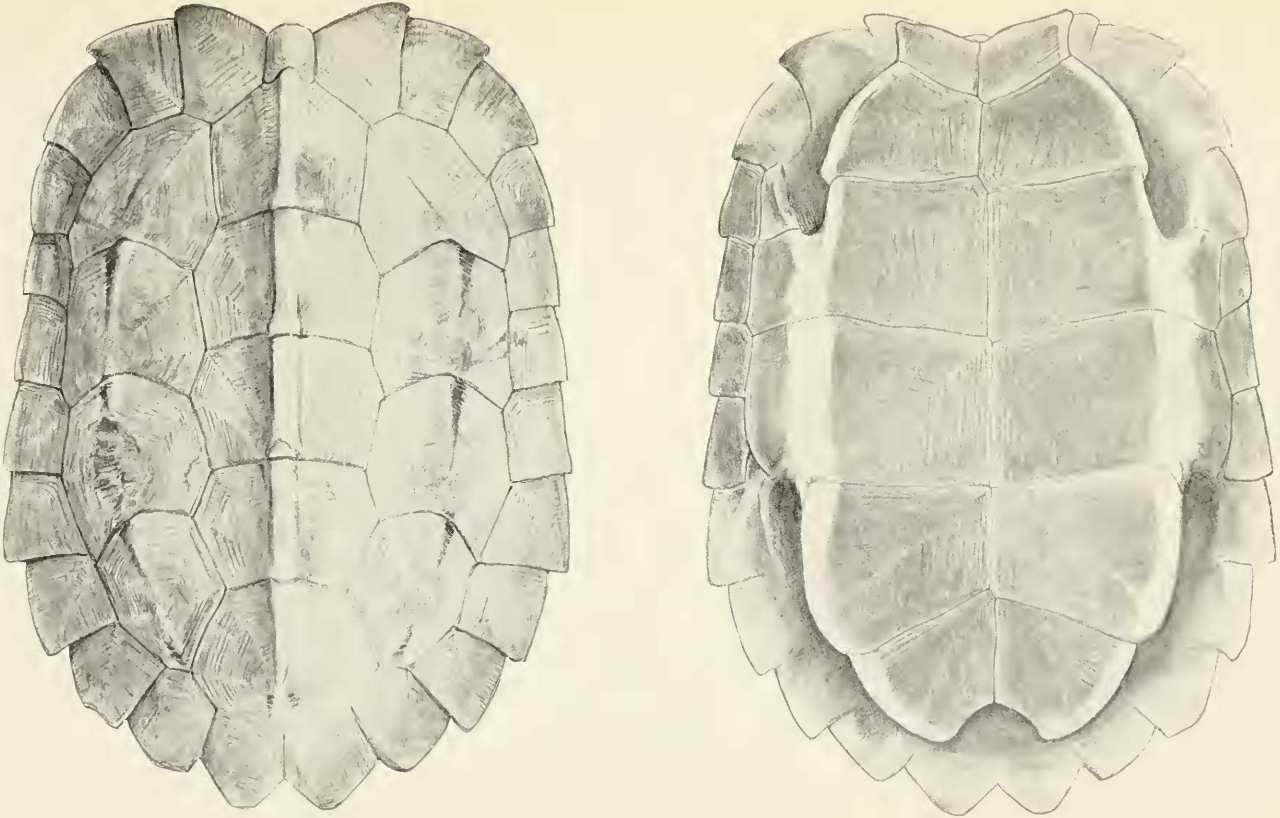
[a] From γῆ, earth, land; and *emyda*, for *emys*, from ἔμυς, turtle.

[b] Proc. Biol. Soc. Washington, XV, Dec. 16, 1902, pp. 237–238.



GEOEMYDA SPENGLERI.

FOR EXPLANATION OF PLATE SEE PAGE 556.



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GEOEMYDA SPENGLERI.

FOR EXPLANATION OF PLATE SEE PAGE 556.

GEOEMYDA SPENGLERI[a] (Gmelin).

YAMA GAME (in Okinawa dialect, according to Okada).

Plates XXXI and XXXII.

1789. *Testudo spengleri* GMELIN, Syst. Nat., I. Pt, 3, p. 1043 (no locality given).—*Geoemyda spengleri* GRAY, Proc. Zool. Soc. London, 1834, p. 100 (China).—*Nicoria spengleri* GRAY, Cat. Shield Rept. Brit. Mus., I, 1855, p. 17 (China).—BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 120 (Sumatra; Borneo; southern China?); Ann. Mag. Nat. Hist. (6), X, Oct. 1892, p. 302 (Okinawa); Proc. Zool. Soc. London 1893, p. 237 (Okinawa).—FRITZE, Zool. Jahrb. Syst., VII, 1894, p. 859; author's separate, p. 10 (Tokuchimura, Okinawa).—*Emys? spengleri* OKADA, Cat. Vert. Japan, 1891, p. 72 (Okinawa shima).

1802. *Testudo serrata* SHAW, Gen. Zool., III, Pt. 1, p. 51, pl. IX, fig. 2 (no locality given).

1804. *Testudo tricarinata* BORY DE ST. VINCENT, Voy. Iles d'Afrique, II (p. 308, pl. XXXVII, fig. 1).

Description.—Female: U.S.N.M. No. 34053; Naha, Okinawa shima; A. Owston collection. Snout short, not projecting, lateral profile vertical, straight; edges of jaws not denticulated, upper jaw hooked medially, without lateral notches; triturating surface of upper jaw narrow without any longitudinal ridge; mandibular symphysis shorter than length of eye slit; head above covered with smooth skin; body rather depressed, its depth being somewhat more than half the width; carapace slightly wider behind, considerably emarginate in front; three well-developed keels; shields (very badly eroded) with distinct concentric lines; nuchal large, broader behind than in front, broader than long; first vertebral pentagonal, slightly broader in front than behind, as long as second and slightly longer than third and fourth, all somewhat broader than long, and as broad as the adjacent costals; edge of marginals from third to eighth slightly turned up; anterior and posterior marginals with their posterior corners greatly projecting, so as to make the anterior and posterior outlines of the shell strongly serrate; first and second marginals broadest; plastron flat, deeply emarginate behind, very obtusely angulate in front with outer anterior corners of gulars projecting; bridge angle gently rounded, shields smooth; posterior lobe slightly longer than bridge, as wide as opening of shell; abdominal and pectoral seams subequal, longest, as long as humeral and gular together, the latter shortest; femoral seam longer than anal, which in turn is longer than humeral; axillary shield distinct, moderate; inguinal shield wanting; forearm anteriorly with large scales the tips of which are pointed and projecting; web between toes emarginate; tail short, rather broad, depressed, with seven pairs of flat square shields on upper surface toward the tip; base of tail and posterior aspect of femur with numerous long, blunt spines. Color (in alcohol): Carapace tawny ochraceous more or less clouded with darker brown; underside black, margins of plastral lobes, bridge angle as well as larger or smaller areas on underside of marginals wax-yellow; head on top dark tawny olive; an indistinct band on canthus rostralis, lower eyelid and on supratemporal region as well as entire neck above pale isabella-color; sides and underside of head and neck blackish with several more or less well-defined, pale isabella-colored markings, viz, a narrow postocular line over tympanic region to sides of neck, a line on posterior half of upper lip crossing the lower jaw at angle of mouth and an irregular broad mark on throat with branches on lower jaw and anterior neck; horny jaws pale brownish; limbs with a couple of ill-defined stripes of same color, and tail above similarly pale.

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[a] For Lorentz Spengler, intendant of the Royal "Kunstkammer" in Copenhagen, from whom Wahlbaum received a shell of this species. Spengler was a conchologist of note. He was born in 1720 and died in 1807.

Dimensions.

	mm.
Greatest length of carapace	128
Greatest width of carapace	84
Greatest length of plastron	113
Length of hind lobe of plastron	41
Width of hind lobe of plastron	59
Width of bridge	38
Depth of shell	49
Width of head	21
Length of tail from vent	24

Variation.—Boulenger, in Chinese specimens, notes the following sequence in the length of the plastral shields, beginning with the largest: Abdominals, femorals, pectorals, humerals, anals, gulars, while our specimen from Okinawa shima and the specimen from Ishigaki shima in the Kumamoto school show the following sequence with regard to their plastral seams, beginning with the longest: Abdominal = pectoral, femoral, anal, humeral, gular. Boulenger also notes the axillary shield as absent, while in ours it is very distinct and well-developed.

Habitat.—The distribution of this species is still of considerable uncertainty, as specimens with undoubted and explicit localities are rare in collections. It is said to occur in Borneo and Sumatra, as well as in southern China. It is not recorded from Formosa, but on the other hand has been received from the Riu Kius.

Holst sent two specimens from Okinawa to the Zoological Society in London, and Doctor Fritze obtained three specimens at Tokuchimura on the west side of Okinawa shima. The Imperial Museum, Ueno Park, Tokyo, also has a specimen from Okinawa, and recently the United States National Museum has obtained, through Mr. Owston, a specimen from Naha (No. 34053).

Professor Ijima has sent me excellent drawings of a specimen belonging to the Kumamoto Higher Middle School. It was collected in Ishigaki shima of the Yaeyama subgroup in February, 1893.

List of specimens of Geoemyda spengleri.

U. S. N. M. No.	Sex.	Locality.	When collected.	By whom collected or from whom received.	Length of carapace.	Width of carapace.	Length of plastron.	Width of hind lobe.	Width of bridge.	Depth of shell.	Tail, from vent.
					mm.	*mm*	*mm.*	*mm*	*mm*	*mm*	*mm*
34053	Female[a]	Naha, Okinawa		A. Owston	128	84	113	59	38	49	24

[a] Description, p. 501.

Genus CYCLEMYS[a] Bell.

1830. *Sternothaerus* Wagler, Nat. Syst. Amph., p. 137 (type, *S. trifasciatus*) (not of Bell, 1825).

1834. *Cyclemys* Bell, Proc. Zool. Soc. London, June, 1834, p. 17 (type, *C. orbiculata*).

1855. *Cuora* Gray, Cat. Shield Rept. Brit. Mus., I, p. 41 (type, *C. amboinensis*).

1863. *Cistoclemmys* Gray, Proc. Zool. Soc. London, 1863, p. 175 (type, *C. flavomarginata*).

1863. *Pyxiclemmys* Gray, Proc. Zool. Soc. London, 1863, p. 176 (type, *Cuora trifasciata*).

1870. *Cystoclemmys* Gray, Suppl. Cat. Shield Rept. Brit. Mus., p. 20 (emendation).

CYCLEMYS FLAVOMARGINATA[b] Gray.

Plate XXXIII.

1863. *Cistoclemmys flavomarginata* Gray, Proc. Zool. Soc. London, 1863, p. 175 (type-locality, Tamsui, Formosa; type in Brit. Mus.; Swinhoe, collector).—Swinhoe, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 220 (Tamsui).—*Cuora flavomarginata* Guenther, Rept. Brit. India, 1864, p. 13, pl. v, fig. A[c] (Tamsui).—*Cystoclemmys flavomarginata* Gray, Suppl. Cat. Shield Rept. Brit. Mus., 1870, p. 20 (China; Formosa).—*Cyclemys flavomarginata* Boulenger, Cat. Chel. Brit. Mus., 1889, p. 135 (Tamsui, Formosa; China?).

1891. *Cuora amboinensis* Okada, Cat. Vert. Japan, p. 72 (Yaeyama) (not of Daudin).—*Emys amboinensis* Fritze, Zool. Jahrb. Syst., VII, 1894, p. 864; author's separate, p. 15 (Yaeyama).

Description.—Adult female; U.S.N.M. No. 34077; Ishigaki shima, Riu Kiu Archipelago; 1899; A. Owston collection. Snout short, not projecting, lateral profile vertical, straight; edges of jaws not denticulated, upper jaw feebly hooked mesially, without notches; triturating surface of upper jaw moderately wide, without any longitudinal ridge; mandibular symphysis shorter than length of eye slit; head above covered with smooth skin; body not at all depressed, its depth being considerably more than one-half its width; carapace slightly wider behind the middle, not emarginate in front; a well-developed vertebral keel and an interrupted keel on each side dividing the costal areoles; shields with small areoles and wide margins with numerous deeply cut concentric lines; nuchal rather large, broader behind than in front, longer than broad; first vertebral somewhat narrower than the others, and like these, with the exception of fifth, angularly emarginate behind; second vertebral slightly longer than broad, longest, the others broader than long, all except fifth narrower than the adjacent costals; sixth to tenth marginals broadest, first slightly narrower; lateral edge slightly turned up; none of the marginals extending beyond the others, the whole outline being entire, not serrate; plastron flat, each shield with deep cut lines, rounded behind and in front; a ligamentous hinge between pectoral and abdominal shields; plastron fastened to carapace with ligament and as wide as opening of shell; abdominal seam longest; anal seam slightly longer than pectoral, which equals humeral and gular seams together; humeral and femoral seams very short, the last one shortest and less than one-fourth the anal seam; axillary present, but inguinal shield wanting; forearm anteriorly with a few large scales, with free, not pointed, edges; digits with a slight web at base; base of tail and posterior aspect of femur with numerous blunt tubercles. Color (in alcohol): Carapace blackish brown, each areole bright chestnut, median keel from middle of second vertebral backward bright buff; plastron uniform blackish brown, marginals underneath and a narrow outer margin on abdominal and pectoral shields pale buff; top of head dark drab, parietal region exteriorly and posteriorly narrowly edged with black, a narrow black-edged bridge of drab on the median line posteriorly joining with the isabella-color of the neck; sides of head pale reddish gray; a narrow black line from upper corner of eye widening backward and bordering beneath a broad pale band, which surrounds the sides and posterior outline of the dark parietal region; the pale, dark-edged band is faintly indicated in front of the eye on the canthus rostralis; neck isabella-color, with indications of longitudinal buff, dark-edged stripes; legs dull ochraceous underneath, palms and soles dusky; tail isabella-colored, with a dusky, longitudinal band on each side and a dusky line on the middle line above and below.

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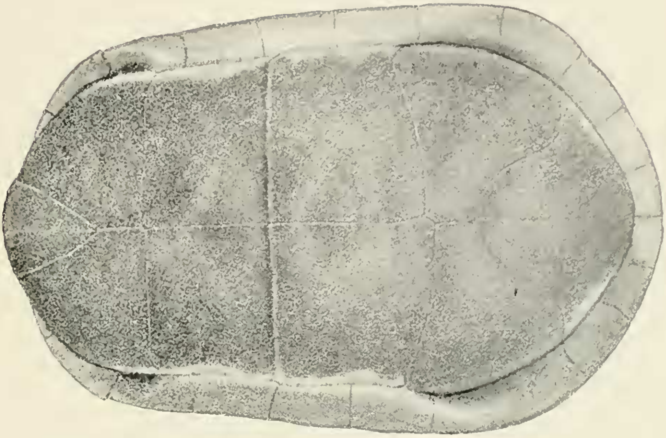
[a] From κύκλος, circle; ἔμυς, river turtle.

[b] Signifying margined with yellow.

[c] Reproduced in this work on Plate XXXIII.

Dimensions.

	mm.
Greatest length of carapace	124
Greatest width of carapace	92
Greatest length of plastron	121
Width of hind lobe of plastron	69
Depth of shell	58
Width of head	21
Length of tail from vent	20



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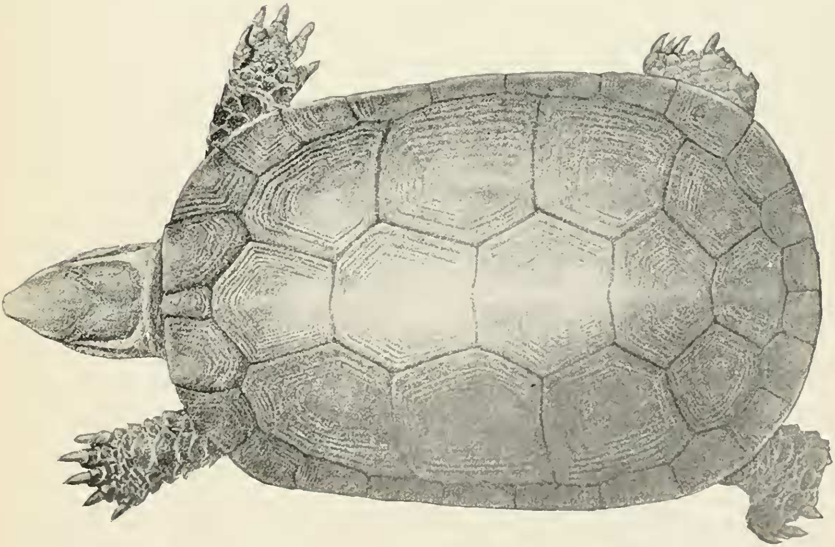

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CYCLEMYS FLAVOMARGINATA. (FROM GUENTHER.)

FOR EXPLANATION OF PLATE SEE PAGE 556

Variation.—As in many other turtles with deeply carved shields there is great variation in the intensity of the sculpturing. Thus No. 34076, also a female but a few millimeters longer than the one described above, is entirely smooth underneath and nearly so above. Otherwise there is but little noteworthy variation in the four specimens before me. In the largest one just mentioned, the femoral seam is slightly longer than the humeral, and the posterior half of the anal seam has become obliterated; in the two younger specimens the pectoral seam is relatively somewhat shorter than in the two adults inasmuch as it does not equal the length of the humeral and gular seams together. All four are practically alike in color.

Habitat.—This species has been recorded from southern China as well as from Formosa, though some doubt has been expressed as to the correctness of the Chinese habitat.

Swinhoe found it to be frequent in the Tamsui River, northern Formosa, where according to him it is the prevailing species.[a]

Four specimens recently acquired by the U. S. National Museum from Mr. A. Owston show that this species also occurs in Ishigaki shima of the Yaeyama subgroup of the Riu Kiu archipelago.

The *C. amboinensis* of Okada and Doctor Fritze, said to occur in the Yaeyama group, is undoubtedly meant for the present species. Doctor Fritze states that from the latter islands it is occasionally brought to Okinawa shima.

List of specimens of Cyclemys flavomarginata.

U.S. N.M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.	Length of carapace.	Width of carapace.	Length of plastron.	Width of hind lobe.	Depth of shell.	Tail, from vent.
					mm.	*mm*	*mm.*	*mm*	*mm*	*mm*
34076	Female....	Ishigaki shima, Riu Kiu...	1899	A. Owston.....	131	93	125	73	56	19
34077	.....do.[a]...	.....do....................	1899	.....do..........	124	92	121	69	58	20
34078	Halfgr.....	.....do....................	1899	.....do..........	92	78	92	58	47	....
34079	Young.....	.....do....................	1899	.....do..........	69	58	65	38	31	13

[a] Description, p. 503.

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[a] "Swinhoe has frequently seen the Tamsui tortoise showing its head and the top of its back on the surface of the water in ponds about the rice-fields, and has watched them basking, several at a time, on the top of large stones in such ponds." (Gray, Suppl. Cat. Shield Rept. Brit. Mus., p. 20).

Family CHELONIIDÆ.

Hard-shelled turtles with paddle-shaped limbs.

A small group of half a dozen species inhabiting the tropical and subtropical seas, often found hundreds of miles from land, but resorting to sandy beaches in order to deposit their numerous round eggs. Full-grown individuals reach an enormous size, 7 feet in length and weighing 800 to 900 pounds. Some species—for instance, the green turtle—are highly esteemed as food, while another furnishes the true "tortoise shell" of commerce.

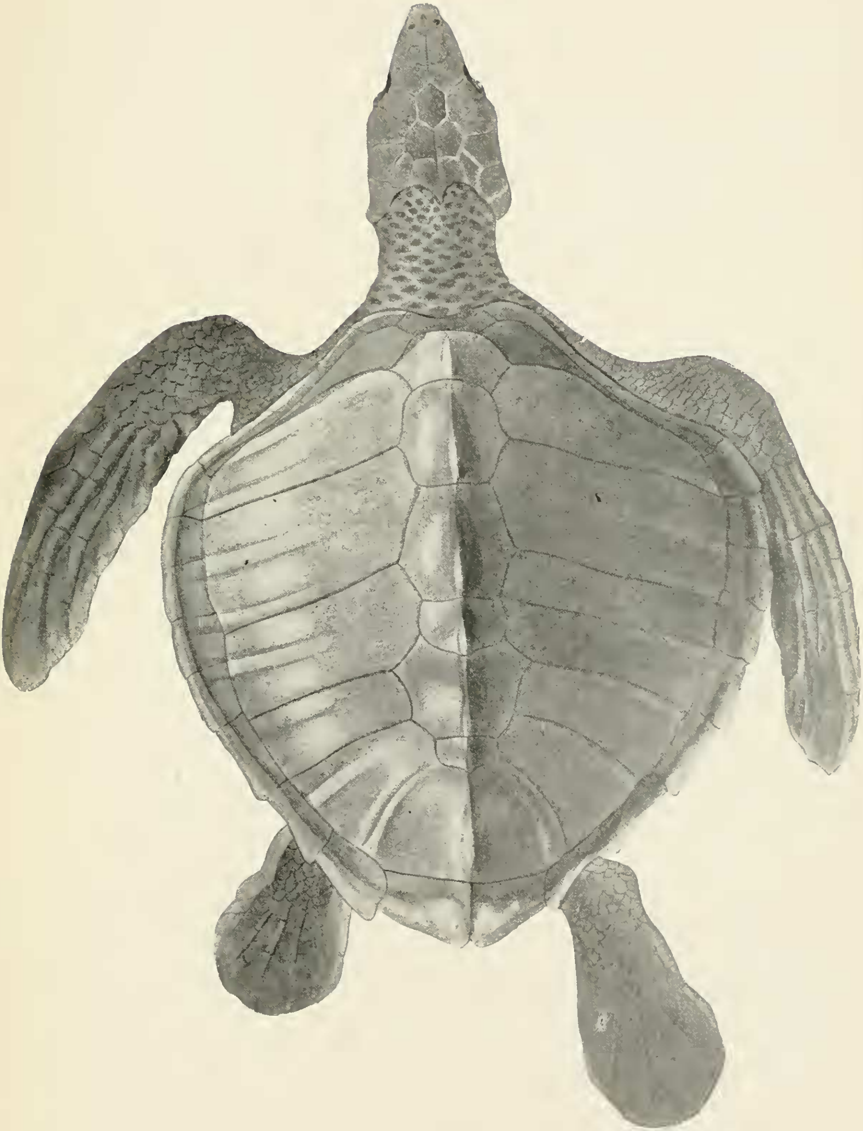
Our knowledge of the marine turtles has advanced very little since the time when Doctor Guenther treated of them in his Reptiles of British India (1864). Boulenger, in his Catalogue of the Chelonians in the British Museum (1889), regards the species which are treated of in the present work as identical with the Atlantic forms, though under the loggerhead turtle he makes the admission that the enormous variation in a large series "leaves no alternative but to further multiply the number of species or to admit only one." It is not impossible that he found similar alternatives in the other species. My own material is too limited to decide the status of these forms, and under these circumstances I consider it much more rational to enumerate the West Pacific forms under names corresponding to those employed by Guenther and Garman. Such a treatment is much less calculated to cause confusion than the opposite one of joining together those which are not with certainty known to belong together.

Dr. R. A. Philippi, of Santiago, Chile, has recently described a number of new marine turtles from that country, but the descriptions are not sufficiently explicit to justify any judgment as to their actual status. Under these circumstances no attempt has been made to correlate any of these new names with those of the marine turtles of the western and northern Pacific.

Only one species of each genus being known to occur within our territory, the key to the genera becomes a key to the species at the same time.

KEY TO THE GENERA AND SPECIES OF CHELONIIDÆ OCCURRING IN JAPANESE WATERS.

a^1 Costal shields 5 pairs, or more . . . . *Caretta olivacea*, p. 507.
a^2 Costal shields 4 pairs.
  b^1 One pair of prefrontal shields . . . . *Chelonia japonica*, p. 509.
  b^2 Two pairs of prefrontal shields . . . . *Eretmochelys squamosa*, p. 511.



Caretta olivacea. (From Eschscholtz.)

For explanation of plate see page 556.

Genus CARETTA[a] Rafinesque.

1814. *Caretta* Rafinesque, Specchio Sci. (Palermo), II, no. 9, 1 Sett., 1814, p. 66 (type, *C. nasuta*=*Testudo caretta*).

1835. *Thalassochelys* Fitzinger, Ann. Wien Mus., I, p. 121 (type, *Testudo caouana*=*T. caretta*).

1838. *Caouana* Cocteau in Sagra's Hist. Fis. Pol. Nat. Cuba, IV, Rept., p. 31 (type, *Chelonia cephalo*=*T. caretta*).

1843. *Lepidochelys* Fitzinger, Syst. Rept., p. 30 (type, *Chelonia olivacea*).

The necessity for adopting Rafinesque's *Caretta* for the present genus has already been pointed out by me in my Herpetology of Porto Rico.[b]

CARETTA OLIVACEA[c] (Eschscholtz).

AKAUMIGAME.

Plate XXXIV.

1829. *Chelonia olivacea* Eschscholtz, Zool. Atlas, Pt. 1, p. 2, pl. iii[d] (type-locality, Manila Bay, P. I.)—*Caretta olivacea* Rueppell, Neue Wirbelth. Abyssin., 1835 (p. 7, pl. iii).—*Thalassochelys olivacea*, Strauch, Chelon. Stud., 1862, (p. 63).—Garman, Bull. U. S. Nat. Mus. No. 25, 1884, p. 301 (Tropical Pacific and Indian oceans).—*Caouana olivacea* Gray, Cat. Tortois. Brit. Mus., 1844, p. 53 (Philippine Isls.).—Guenther, Rept. Brit. India, 1864, p. 52 (seas of Philippine Ils. and of China).—*Lepidochelys olivacea* Girard, Herpet. U. S. Expl. Exped., 1858, p. 435.

1831. *Chelonia caretta β olivaeea* Gray, Synops. Rept., I, p. 54 (China).

1835. *Chelonia dussumierii* Duméril and Bibron, Erpét. Gén., II, p. 557 (coast of Malabar; types in Paris Mus.).—Duméril, Cat. Méth. Rept. Mus. Paris, I, 1851, p. 25.

1857. *Lepidochelys dussumieri* Girard, Herpet. U. S. Expl. Exped., p. 437.

1880. *Thalassochelys corticata* Hilgendorf, Sitz. Ber. Ges. Naturf. Fr. Berlin, 1880, p. 112 (Japan) (not of Girard, 1858).

1891. *Chelonia caouana* Okada, Cat. Vert. Japan, p. 72 (not of Schweigger, 1814) (Awa, Hondo; Toza; Bonin Is.).—Mitsukuri, Zool. Mag., Tokyo, III, no. 35, Sept. 1891, p. 364 (breeding habits, etc.); Journ. Sci. Coll. Tokyo, VI, 1893, p. 227 (Sagara, prov. Totomi), X, Pt. 1, 1896, pp. 11, etc. (embryology).

The Asiatic loggerhead turtle is easily distinguished from the other marine turtles of the Far East by having more than four pairs of costal shields. Like the hawksbill it has two pairs of prefrontals, but the shields on the carapace are not imbricate. The figure of the young Atlantic loggerhead will help placing any specimen of the group in the proper genus, but it should be remembered that the vertebral and costal shields in *C. olivacea* are apt to be more numerous. No authentic specimen from Asiatic waters is in our collection, hence no detailed description is feasible at present. (Figs. 389–392.)

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[a] The name Caret (new Latin *Caretta*) according to Lacépède is the one by which the hawksbill turtle is generally known in the country it inhabits. Carey is Spanish for tortoise shell.

[b] Report U. S. Nat. Mus., 1902, p. 714.

[c] Signifying olive-colored.

[d] Reproduced in this work on Plate XXXIV.

Habitat.—Notwithstanding the fact that the present species is not included in the list of Japanese reptiles in the Fauna Japonica, it is probably the most common of the marine turtles in that part of the world. Professor Mitsukuri writes that this species "deposits its eggs on almost every suitable stretch of sandy beach in the southern half of Japan during the summer months of the year." Special localities are mentioned by Okada as Awa, Hondo, and Toza, also

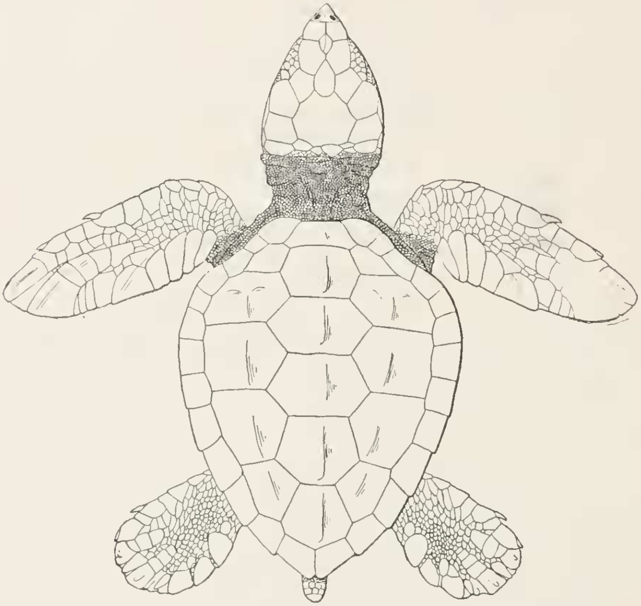
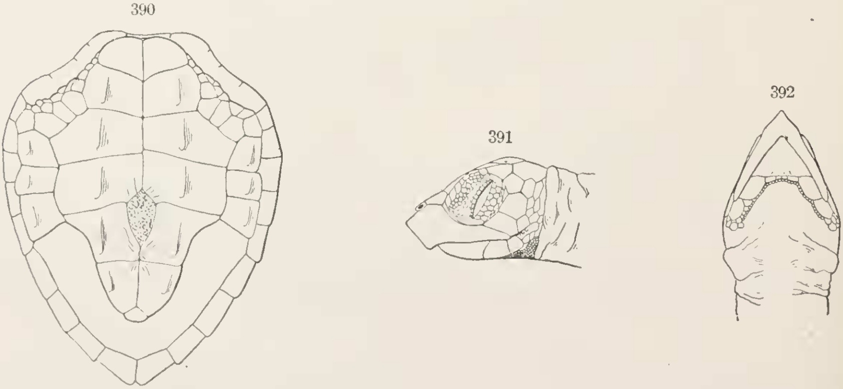


FIG. 389.—CARETTA CARETTA, YOUNG. NAT. SIZE. ENTIRE ANIMAL FROM ABOVE. NO. 14823, U.S.N.M.



FIGS. 390–392.—CARETTA CARETTA, YOUNG. NAT. SIZE. 390, SHELL FROM BELOW; 391, HEAD FROM SIDE; 392, UNDERSIDE OF HEAD. NO. 14823, U.S.N.M.

Bonin Islands, and Professor Mitsukuri collected a large number of eggs at Sagara, province of Totomi, for embryological studies. Dr. S. Nozawa writes me that the Pacific loggerhead occasionally straggles to Yezo.

Genus CHELONIA[a] Latreille.

1800. *Chelonia* Brongniart, Bull. Soc. Philom. Paris, II, p. 89 (*nomen nudum*).
1802. *Chelonia* Latreille, Hist. Nat. Rept., I, p. 22 (type, *C. mydas*).
1806. *Chelone* Brongniart, Mém. Sav. Étrang., I, p. 610 (emendation).
1814. *Chelonias* Rafinesque, Specchio Sci. (Palermo), II, No. 9, 1 Sett., 1814, p. 66 (emendation).
1838. *Mydas* Cocteau in Sagra's Hist. Fis. Pol. Nat. Cuba, IV, Rept., p. 22 (type *C. mydas*) (not of Fabricius, 1799).
1843. *Mydasea* Gervais, Dict. d'Hist. Nat., III, p. 457 (same type).
1845. *Euchelonia* Tschudi, Fauna Peruana (p. 22) (same type).
1848. *Megemys* Gistel, Naturg. Thier., p. viii (substitute for *Chelonia*).
1858. *Euchelys* Girard, Herpet. U. S. Expl. Exped., p. 447 (type, *E. macropus*).

CHELONIA JAPONICA (Thunberg).

ARAUMIGAME.

1787. *Testudo japonica* Thunberg, Svensk. Vetensk. Acad. Nya Handl., VIII, p. 178, pl. vii, fig. 1 (Japan).—*Chelonia japonica* Schweigger, Prodr. Mon. Chelon., 1814, p. 21.
1814. *Chelonia virgata* Schweigger, Prodr. Mon. Chelon., p. 21 (seas of the Torrid Zone).—Duméril, Cat. Méth. Rept. Mus. Paris, I, 1851, p. 24 (Indian Ocean; New Guinea).—Swinhoe, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 221 (Formosa).—Guenther, Rept. Brit. India, 1864, p. 53 (Formosa).—Garman, Bull. U. S. Nat. Mus., No. 25, 1884, p. 302 (tropical portions of Western Pacific and Indian oceans).
1820. *Caretta thunbergii* Merrem, Syst. Amph., p. 19.
1831. *Chelonia mydas ζ japonica* Gray, Synops. Rept., I, p. 53 (Japan).
1835. *Chelonia viridis* Temminck and Schlegel, Fauna Japon., Rept. (part; not of Schneider), p. 18 (part; Indian Archipelago to Japan), p. 139 (Japan); pl. iv, figs. 4, 5, 6 (Indian Ocean), pl. vi, figs. 1, 2 (Moluccas).—Namiye, Cat. Spec. Vert. Educ. Mus. Tokyo, 1881, p. 84 (Ogasawara shima).—Okada, Cat. Vert. Japan, 1891, p. 72 (Bonin Is.; Koge shima).
1860. *Chelonia mydas* Hallowell, Proc. Phil. Acad. 1860, p. 486 (not of Linnæus) (Bonin Islands).—*Chelone mydas* Boulenger, Cat. Chel. Brit. Mus., 1889, p. 180 (part; Malay Peninsula; Formosa; Bonin Islands).

An examination of Thunberg's plate[b] leaves no doubt as to the identity of the sea-turtle he describes, the four pairs of costal shields and one pair of prefrontals being plainly shown and quite conclusive. The figure is not a bad one for the time and is easily identified. It has nothing to do with *Caretta olivacea*.

The "green" turtle is easily identified by the single pair of long prefrontal shields. The carapace has only four pairs of costal shields, like the hawksbill, but in the latter the dorsal shields are more or less imbricate, so that no confusion between the two species should occur.

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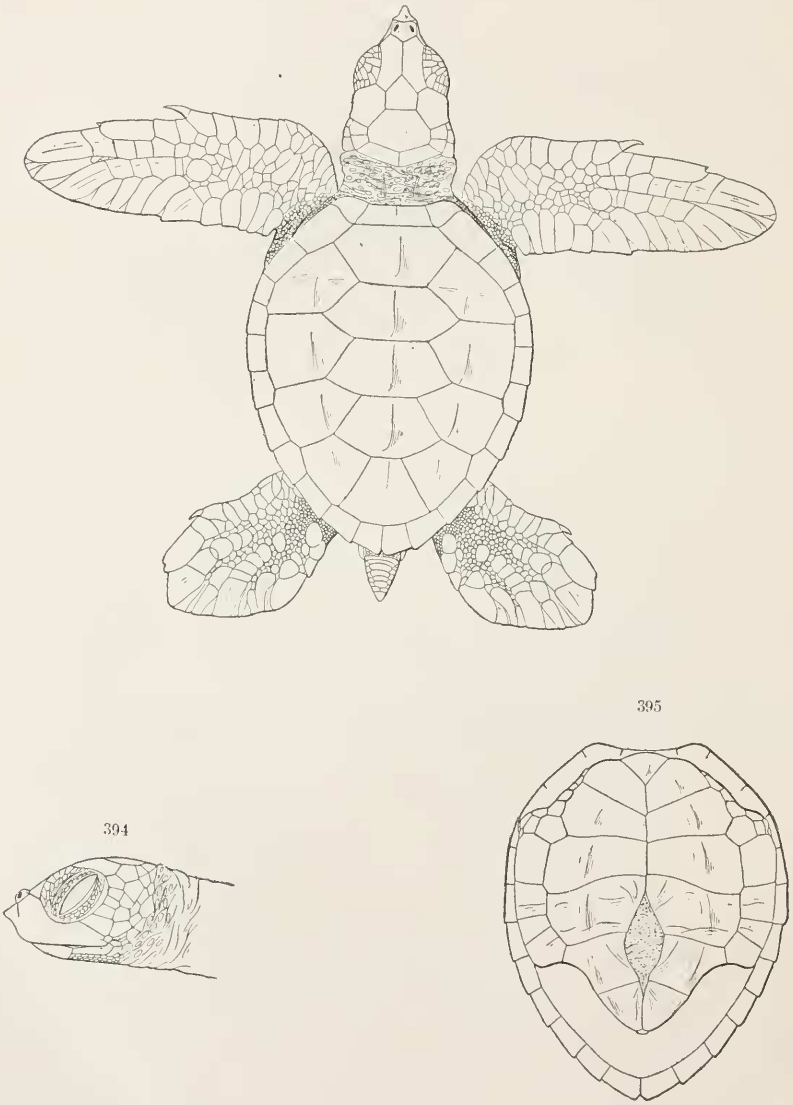
[a] From χελώνη, turtle.

[b] Svensk. Vetensk. Acad. Nya Handl., VIII, 1787, pl. vii.

Several views of a young specimen from the Bonin Islands, just hatched (figs. 393–395), will help in the identification of this species.

Habitat.—Widely distributed in the tropical part of the Pacific Ocean, but apparently less common on the coasts of Japan than the other species, judging from the scant records available. It breeds on the Bonin Islands, and may be the prevailing species there.



FIGS. 393–395.—CHELONIA JAPONICA, YOUNG. NAT. SIZE. 393, ENTIRE ANIMAL FROM ABOVE; 394 SIDE OF HEAD; 395, PLASTRON. No 7706, U.S.N.M.

List of specimens of Chelonia japonica.

U.S. N.M. No.	Sex and age.	Locality.	When collected.	By whom collected or from whom received.
7705	Young	Port Lloyd, Bonin Islands	1854	W. Stimpson.
7706	....do.[a]	....do	1854	Do.
7707	....do	....do	1854	Do.
33858	....do	Haha shima, Bonin Islands	Mar., 1904	A. Owston.

[a] Figs. 393–395.

Genus ERETMOCHELYS[a] Fitzinger.

1828. *Caretta* RITGEN, Nova Acta Acad. Leop. Carol., XIV, p. 270 (type, *Chelonia imbricata*) (not of Rafinesque, 1814).

1843. *Eretmochelys* FITZINGER, Syst. Rept., p. 30 (same type).

1873. *Onychochelys* GRAY, Proc. Zool. Soc. London. 1873, p. 397 (type, *O. kraussi*).

ERETMOCHELYS SQUAMOSA[b] (Girard).

TAIMAI.

1769. *Testudo imbricata* PENNANT, Indian Zool., (p. 87) (not of Linnæus 1766).—*Chelonia imbricata* TEMMINCK and SCHLEGEL, Fauna Japon., Rept., 1835, pp. 13, 139, pl. V, figs. 1–2 (Japan); pl. VI, fig. 4 (Moluccas).—OKADA, Cat. Vert. Japan, 1891, p. 72 (Okinawa shima).—*Chelone imbricata* STRAUCH, Chelon. Stud., 1862 (p. 181) (part); Mém. Acad. Sci. St. Petersb. (7), XXXVIII, No. 2, 1890, p. 121 (part: Carmen Isl. etc.).—BOULENGER, Cat. Chel. Brit. Mus., 1889, p. 183 (part: Formosa, etc).

1857. *Eretmochelys squamata* AGASSIZ, Contr. Nat. Hist. U. S. Am., I, p. 382 (Indian and Pacific oceans; Japan) (not *Testudo squamata* Gmelin).—GARMAN, Bull. U. S. Nat. Mus. No. 25, 1884, p. 300 (tropical Pacific and Indian oceans).—*Caretta squamata* SWINHOE, Ann. Mag. Nat. Hist. (3), XII, 1863, p. 221 (Tamsui, Formosa).—GUENTHER, Rept. Brit. India, p. 54 (Formosa).

1858. *Caretta squamosa* GIRARD, Herpet. U. S. Expl. Exped., p. 442, pl. XXX, figs. 1–7 (Sulu Seas and Indian Ocean).

1858. *Caretta rostrata* GIRARD, Herpet. U. S. Expl. Exped., p. 446, pl. XXX, figs. 8–13 (Fiji Isls.; type in U. S. Nat. Mus.).

The hawksbill, or tortoise-shell turtle, has two pairs of prefrontals, like *Caretta olivacea*, but only four pairs of costal shields, like *Chelonia japonica*, the vertebral shields being more or less pointed behind and imbricate. The details of structure are shown in the figures of *E. imbricata* (figs. 396–400), and will aid in the identification in default of description and figures of Japanese specimens, of which there are none in our collection.

Habitat.—The capture of this species is an important fishery in the Riu Kius, and the tortoise-shell industry is one of considerable magnitude in Nagasaki. That the hawksbill occasionally straggles farther north is evidenced by its having been taken once off Nemuro, northeast Yezo, according to Doctor Nozawa.

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[a] From ἐρετμόν, oar; χέλυς, turtle.

[b] Signifying scaly, with reference to the imbrication of the dorsal shields.